THE JOURNAL
OF THE
ROYAL UNITED SERVICE INSTITUTION.

VOL. XXXIX. APRIL, 1895. No. 206.

SIR GEORGE ROOKE,

ADMIRAL OF THE FLEET.

By J. K. LAUGHTON, M.A., R.N., Professor of Modern History at King's College, London.

GEORGE ROOKE, of an old Kentish family, son of Sir William Rooke, was born in 1650. He seems to have served in the Navy as a Volunteer through the second Dutch war, and in 1672 was lieutenant of the "London" in the battle of Solebay. In 1673 he was lieutenant of the "Royal Prince," carrying the flag of Sir Edward Spragge, Admiral of the Blue Squadron in the action of June 4th. When the "Royal Prince" was disabled and Spragge shifted his flag to the "St. George," Rooke was left in command. The story is told—though on very doubtful authority—that as a large Dutch ship, convoying two fire-ships, was bearing down on her, in the apparent certainty of capturing or burning the disabled ship, Rooke ordered the flag to be struck, but was prevented by the gunner, Richard Leake, who ordered Rooke to go below, saying, "The 'Royal Prince' shall never be given up while I am alive to defend her." Leake's two sons, Henry and John (the future Admiral of the Fleet), supported him. The men recovered from their panic, the fire-ships were sunk, the man-of-war beaten off, and the "Royal Prince" safely brought to Chatham. That Leake distinguished himself on the occasion is very probable, and in 1673 the rank of a gunner was much higher than it is now, or was through the eighteenth century; but the detail of his ordering Rooke below, or taking the command from him, would require very strong evidence in support of it, and the more so as, in the following November, Rooke was promoted to the command of the "Holmes," from which he took post.

During the following years he commanded the "Nonsuch," the "Hampshire," and the "St. David" in the Mediterranean in the squadron under Narbrough or Herbert, and in 1688 was captain of the "Deptford," a 50-gun ship. Rooke is always counted as a Tory; but his political principles did not lead him, at this time, to run counter to the general feeling of the Navy, which was distinctly adverse to James II. In May 1689, he commanded the "Deptford" in the battle of Bantry Bay, and was afterwards sent with a small squadron to the relief of Londonderry, then besieged by the forces of the deposed King. That Londonderry was relieved, we know; but Rooke's share in the operations is somewhat

doubtful. It is certain that the squadron lay in Lough Foyle for several weeks, without even attempting to succour the town ; and that the boom was actually broken by the "Dartmouth" (Captain John Leake), rather with Rooke's permission than by his orders. Whether from political interest, or as being judged a capable officer, he was, early in 1690, promoted to flag rank, and took part in the battle of Beachy Head as Rear-Admiral of the Red Squadron with his flag in the 90-gun ship "Duchess." Lord Torrington was his old friend and commander, and Rooke's evidence on the court-martial, which is said to have been very much in Torrington's favour, cannot but have had a certain personal bias.

In 1692, Rooke, as Vice-Admiral of the Blue Squadron, with his flag in the "Neptune," was present at the battle of Barfleur. During the greater part of the day the Blue Squadron was helplessly to leeward, but in the afternoon a shift of wind permitted it to lie up to windward of the French line, thus placing the enemy between two fires, from which a lucky fog permitted them to escape for the time. When a part of their fleet had taken refuge in the Bay of La Hogue, the junior flag officer was ordered to take command of the boats and burn the enemy's ships. The Rear-Admiral of the Blue had been killed in the action; the Rear-Admiral of the Red was sick ; the duty devolved on Rooke, who hoisted his flag on board the "Eagle," of seventy guns, and, standing close in with a squadron of the smaller ships of the line, sent in the boats and set fire to the French ships of war and transports. Never was an operation of war more complete, and Rooke rightly received much credit for the way it was carried out. The King is said to have settled on him a pension of £1,000 a year. This is doubtful ; but it is certain that in the spring of the following year, the King, going to Portsmouth, dined on board Rooke's ship, and knighted him.

In May, 1693, he was appointed to convoy the trade to the Mediterranean, consisting of about four hundred merchant ships, English and Dutch. For this service he had a force of thirteen ships of from forty to sixty guns, six smaller vessels, and eight Dutch ships under Vice-Admiral Van der Goes. The exceptional value and importance of the convoy rendered necessary exceptional measures for its defence; and the Grand Fleet, under the command of the joint admirals, Shovell, Delavall, and Killigrew, sailed with it for its further protection. They assumed, however, that the French Fleet must be in Brest. They did not take any measures to ascertain whether it was or was not; and when they had seen the convoy some fifty leagues to the south-west of Ushant, parted company, and returned to St. Helens. Rooke, with the convoy, went on, fearing no further danger, for his squadron was of overpowering strength against any attack from the enemy's cruisers, and on rounding Cape St. Vincent found himself unexpectedly in the presence of the whole navy of France, which had lain in Lagos Bay, as it were, in ambuscade. Against such a force Rooke's squadron could do nothing. Squadron and convoy dispersed and fled, but a very large number of the merchant ships were captured. Rooke made his way to Madeira, and thence

returned to the Channel. But not the least curious part of the business is, that no blame for this terrible loss fell on him. The ministry and the joint admirals were sharply criticised for not having informed themselves of the whereabouts of the enemy's fleet; but everybody seems to have considered that Rooke, whilst having a sufficient number of small craft at his disposal, was in no way bound to have look-out ships well ahead, which might have given timely warning of the danger.

In April, he was appointed one of the Lords Commissioners of the Admiralty and Admiral of the Blue Squadron. In September, 1695, he was appointed Admiral of the White and Commander-in-Chief in the Mediterranean, whence he returned in the following April, and, after commanding in the Channel for some weeks, was summoned to London to attend his duties at the Admiralty. In 1697, he again commanded the fleet in the Channel; and, falling in with a fleet of Swedish merchantmen on the coast of France, sent them all in for adjudication. Out of this grew an angry controversy, but the ships were all condemned, proving to be, as Rooke had suspected, really French, sailing under the Swedish flag.

When the war broke out again in 1702, Rooke, as Commander-in-Chief, with the Union Flag at the main, led an expedition against Cadiz, the Duke of Ormonde accompanying him in command of the troops. The expedition was unsuccessful. In the last century joint expeditions of sea and land forces, under a divided command, generally were unsuccessful, and the friends or partisans of the two commanders invariably laid the blame of the failure on the other. In this instance, the angry recrimination, which might have followed, was avoided by the fortunate intelligence that a fleet of Spanish treasure ships, under the escort of a strong squadron of French men-of-war had put into Vigo. Rooke and Ormonde at once went to look for them; found them, as reported, in Vigo, guarded by a strong boom. The troops were landed; the boom was broken; the ships were sunk or taken possession of, brought away, or burnt; but the fate of the treasure was never known. What was captured was but a small fraction of the whole, and it was long supposed that much of it was sunk. During the 193 years that have since elapsed, several attempts have been made to recover the treasure, but always without result; and the general opinion now is that most of it was landed before the attack was made. On his return to England, Rooke was sworn a Member of the Privy Council.

In 1704 he was appointed Commander-in-Chief of the fleet which took the Archduke Charles, the titular King of Spain, to Lisbon. Afterwards he carried to Barcelona Prince George of Hessen-Darmstadt and such soldiers as were available. It was, however, found that the force was altogether too small to reduce the town, and the troops were re-embarked. Coming back down the Mediterranean, and anxious to do something to stifle the outcry that would be surely raised if the fleet returned without any result whatever, it was resolved, in a council of war, to attempt Gibraltar, the garrison of which was understood to be ridiculously weak. The fleet suddenly appeared in the bay; Prince

George, with the soldiers and marines, was landed on the neutral ground; George Byng, with a strong detachment of the fleet, took up a position opposite the batteries, and after a lively cannonade landed at the main bastion. The fortress surrendered. Prince George was left in command, with the soldiers and part of the marines, and an adequate supply of guns and ammunition; and Rooke, with the fleet, sailed eastward to prevent the French, under the Count of Toulouse, attempting a re-capture. The two fleets met off Malaga on August 13th. The numbers were nearly equal; but the English ships wanted part of their marines, and were short of ammunition, both by reason of what had been expended and what had been left at Gibraltar. Rooke, too, had repeated the order which had come to him from the Duke of York through Russell: The fleet, being to windward of the enemy, was to range itself in a line parallel to theirs, and engage along the whole length, van to van, rear to rear. On this plan the battle was fought till the day closed. Several of the English ships, having fired away all their ammunition, quitted the line; many of the French also quitted the line, beaten out of it, according to the English story; but no satisfactory result was to be expected from such tactics. So far as the fighting was concerned, the battle was drawn; but Toulouse, recognising that, in face of a fleet which he could not defeat, it was impossible to make any attempt on Gibraltar, drew back to Toulon; and Rooke, taking such measures as were possible for the safety of the fortress, returned to England.

The country was just then enthusiastic over the news of Blenheim, and the Whigs were boastful of a victory gained on shore. The Tories put forward Malaga as a victory gained at sea, and as the equal of Blenheim. Rooke was put forward as the peer of Marlborough. Such exaggeration wrought its own punishment; and by a natural re-action Rooke and Malaga, after being for a time unduly extolled, were allowed to sink into comparative oblivion. At the time, however, the spirit of faction ran very high; the friends of Marlborough were in power, and considered it in their right to shelve a man whose partisans had presumed to compare with the great Duke. It is not to be supposed that Marlborough had any hand in the dirty business, but the result was that Rooke was superseded from the command, and was not employed again. He died, aged fifty-eight, on January 24th, 1709. There is a monument to his memory in Canterbury Cathedral. He was twice married, and by his second wife, Catherine, daughter of Sir Thomas Knatchbull, of Mersham Hatch, left one only son, George.

Saturday, March 9th, 1895.
Field-Marshal Sir J. LINTORN A. SIMMONS, G.C.B., G.C.M.G.,
in the Chair.

The CHAIRMAN: Ladies and gentlemen,—It will require no words on my part to introduce to you the distinguished statesman who is kind enough to come here to give us this Inaugural Address. You all know the career of Sir Richard Temple. He has been before the British public for years. He has achieved a distinguished career in India, and a high position as an administrator and as a diplomatist; and, instead of coming home to enjoy his *otium cum dignitate*, he has employed himself here in the most useful way to the country as a Member of Parliament, and also in taking a large part in the system of education of this great Metropolis. (Hear, hear.) I am sure the experience that he has gained in India enables him to know thoroughly what soldiers and sailors require, and what is required of them to enable them to perform the important duties they have to fulfil in all parts of the world. I, therefore, venture to think you will agree with me that the Council has been wise in asking Sir Richard Temple to give us this Inaugural Address. I am only sorry that the Chairman, General Erskine, is prevented by illness from being present, which accounts for my filling the chair on this occasion. I have now the pleasure of asking Sir Richard Temple to address you.

THE INAUGURAL ADDRESS.

By Sir RICHARD TEMPLE, Bart., G.C.S.I., LL.D., D.C.L., M.P.

Sir RICHARD TEMPLE: Field-Marshal, my lords, and gentlemen,—I feel much honoured in being invited to deliver the address upon this most interesting occasion. The number and the magnitude of the points which I shall have to bring before your notice will compel me to take a survey of the most rapid character, and if I shall seem to pass over too quickly any one of these points, you must excuse me, owing to the vastness of the subject and the exigencies of time.

In no country is an Institution like the present more needed than in England, because there is no nation that is so entirely dependent as we are upon our fighting power. Though we have more staying power in the event of indecisive warfare than any other nation, nevertheless, we cannot bear any decisive defeat. Other Continental or European powers might suffer such disaster, and yet preserve their nationality. France has suffered such, and has remained still France; so have the Germans, but still Germany has been Germany; the Russians also, still Russia has remained Russia. If we were to suffer such a disaster, England would be no longer the England of the nineteenth century. Therefore, no nation must pray so earnestly to the God of battles that the hearts of our fighting men may be steeled; no nation is so bound to preserve an unquestioned ability to hold its own by force of arms as our own. (Cheers.)

Now, what I shall have to say will apply equally to soldiers and to sailors, because, if you reflect, under no conceivable circumstances, except one, can we operate in the future otherwise than by a combination of our sea and our land forces. No doubt there is one grand exception, namely:

when the battle of Armageddon shall have to be fought between the lion and the bear for the Empire of the East on the frontier of Afghanistan. Even then, if the triumph—as we hope—shall accrue to England, it will be largely owing to the superiority and proximity of her base upon the sea. (Cheers.) So the term "British officer," which I shall use in what I have to say, applies equally to a naval and to a military man.

And the subject of my address will be this: "The Extraneous Professional Culture that is required for British Officers." Before an audience like this it would be presumptuous on my part to dilate upon ship-building and naval gunnery and evolutions at sea, or upon tactics and strategy by land. But, gentlemen, there are vast numbers of subjects which are cognate to the profession of arms, which, though they are in some degree extraneous to it, are nevertheless kindred and allied, and they embrace subjects which must be mastered by every British officer who aims at being accomplished in his noble profession. Therefore, my address will relate, I repeat, to the extraneous professional culture needed for British officers.

Now, this really splendid subject—far too splendid for me to treat adequately—divides itself, naturally, into two parts: first, the material; and secondly, the moral and personal.

As regards the first part, the "material," that will be divided into several sub-heads, the first of which is that of "Empire." The thought must never be absent from the mind of a British officer that he is not serving a homogeneous kingdom like that of the great European Powers, but he is serving a heterogeneous Empire scattered over the world (cheers); and in reference to that he should study everything that relates to Imperial Federation. Now, I shall not dwell here upon the various economical, political, social, and commercial advantages derived from Imperial Federation, but before this professional audience I shall mention one military advantage of the very first importance. If our colonies remain a part of the Empire, their ports are friendly ports—are British ports in the event of war; if by any chance they shall become separate, then, though they may be friendly, yet their ports will remain neutral ports. Now, I need not dwell upon the awful disadvantage to us, with our scattered commerce, if the Cape, Sydney, or Melbourne, or the great Canadian ports were neutral. The disadvantage would be too fearful to contemplate. Therefore, I say, one of the primary objects of study to a British officer should be everything that relates to Imperial Federation. (Cheers.)

The next sub-head relates to our dangers at home and abroad. It follows, with regard to such an Empire as that which I have called to your remembrance, there must be both.

As regards the dangers "at home," I must beg forgiveness if I excuse myself from dwelling upon them at this moment. There is really no time. It would require a separate address to deal adequately with them. Therefore, I shall not pause to consider the grave questions which arise at home, viz., whether our coasts are adequately defended; whether the strategical positions between the coast and the Metropolis are adequately

occupied; whether the main military communications leading to the Metropolis are protected or not; whether we have our military arsenals, and, above all, our military factories, sufficiently situated inland out of reach of an enemy by a *coup de main*. These most serious questions I must leave for another occasion if ever they are to be treated by me.

But I may on this occasion briefly summarise to you what I suppose to be our immediate dangers abroad. These dangers, indeed, are never the same. They were different in the last decade. They will be different in the next decade. I shall only summarise those dangers which are immediately present, and which are existing at this very moment. Now, let us think what they are, because they require ceaseless study by every British officer, always with the reservation that they will vary from year to year. But let us take the example of the present moment. Now, think of our dangers.

Take the case of Russia. Look at that red spot in Armenia. Supposing Russia should be thereby induced to cross the Armenian frontier, why, then, the whole Eastern Question is opened. Then consider the present war between China and Japan. Supposing China falls to pieces, who will claim the lion's share of the spoil or the bear's share? And have you ever considered the new railway which is being projected from Moscow to Vladivostock, near the mouth of the Amur? That railway will run all along the northern frontier of the Chinese Empire. That once made, it will be as easy for Russia to annex North China as it would be to pick up a ripe apple that has fallen from the tree. Then even the success of Japan may constitute a new naval power, friendly to us perhaps, but possibly necessitating the provision of some additional stations for us. Then I need not remind you of the tiger-like advance of Russia all through Central Asia during the last generation. She has now got, as you are perhaps aware, the means of advancing close up to Herat, and, upon a declaration of war, of pouring forth her masses of soldiery over Afghanistan just as a torrent of lava from Vesuvius would flow towards Naples. No doubt every British officer will study, with extreme interest, our counter-preparations on the north-west frontier of India, our network of railways leading right up to the frontier, reaching the Punjaub, the Indian Mesopotamia, and our arrangements for advancing even beyond the frontier, if necessary, to meet the enemy half way. But, at the best, all this does constitute a very serious combination and concatenation of dangers.

Now, take the case of France. She is notoriously dissatisfied, I might say, even spiteful, against us for our occupation of Egypt. We shall have to continue that occupation for an indefinite period, let France say what she will. But she now has violently advanced upon Siam, annexed a great part of that country, and nothing but the interference of England saved Siam from being absorbed *in toto*. Now these events place our Eastern Empire between two fires. We have already got a frontier towards Russia, on the West; we shall soon have a frontier towards France, on the Eastern side of the Empire. Then, again, France has virtually annexed Madagascar. She, no doubt, finds it a hard nut to

crack; but still, some fine day she will establish a naval station there, threatening our trade and our naval route from the Cape to India. (Hear, hear.)

Next take the North-Eastern part of Africa—that really British sphere of influence from the Great Lakes beyond the source of the Nile, right down by the Soudan to Egypt, at the mouth of the Nile; in fact, the whole Nile Valley from source to mouth is in British interests. But that is the very line which France has been endeavouring to threaten—and seriously threaten—by the recent Congo State arrangement. Then take Southern Africa; have you noticed all these affairs in the Transvaal and Swaziland? Now, apart from all moral obligations towards the Swazis, into which I do not enter, there is this great naval difficulty—that the annexation of Swaziland will bring the Boers to the sea. Have you read the overwhelming insolence of the Dutch President, when he said that as soon as the Transvaal should be a naval power it would be able to combine either with Germany or France against England? If anything of that kind should happen, look at the great Africander Party springing up in South Africa. All that means, of course, the possibility of some influences hostile to the Imperial connection of England.

Now, apart from all these dangers, there are two bright spots. There used to be dread about the safety of Eastern Australia in the event of war with Russia. That apprehension has happily passed away. In the words of a military expert, used to me the other day, no Power could look at us on these Australian waters, so strong have we become. Then again, the danger of war between the two great families of the English-speaking race in connection with the Behring Straits and the seal-hunting have subsided, the matter having been settled by arbitration. But even then we notice that the American House of Representatives are now beginning to object to some of the terms of the arbitration, evidently determined to accept no arbitration decision unless it be in their favour. I hope that will not be persevered in. But, surely, I have said enough to show to every British officer that he lives in an Empire which from its nature is perpetually threatened by danger, and which can be sustained only by the valour of her sons. (Cheers.)

Well now, to meet all such dangers, let me ask British officers to consider the nature of our fighting power, both by sea and land.

And first, as regards sea. Now, the basis of maritime power, of course, is commerce. It is the vast quantity of imports which we consume—the large imports of food. We are chiefly fed by our imports; but how do we pay for those? Why, we pay in part by exporting our manufactures; in part also by the tribute which we draw from every nation under heaven, in the shape of interest upon the investment of British capital. We pay in part also by our freight earnings, because we are the carriers of the world, and our freighters will help to pay for the food which we import. This, too, is the real basis of our maritime power. I was referring the other day to perhaps the most thoughtful book that ever was written upon maritime power, I refer to

Captain Mahan's American book upon Sea Power. He analyses most lucidly the various reasons why this Power and that Power has been great or strong at sea, and, of course, he devotes a great share of his attention to us. But with all deference to him, I believe he has missed, or perhaps it was not suitable for an American to state, what is the real cause of our maritime preponderance in this generation. It is simply this, that by Protective duties upon various articles other nations have destroyed their own ship-building yards, and thrown the whole business—perhaps the most important of all businesses upon earth—into the hands of the British. The consequence is that we own more than half of the shipping of the world, and that even a large portion of the shipping which does run under foreign flags is built in England. Now, that gives us an enormous advantage. It employs hundreds of thousands of our seafaring coast inhabitants and fishermen on board ship; some estimate it at a quarter of a million, some even put it as high as one-third of a million. Of course, this brings us wealth and might untold from every portion of the globe, and it has verified the old song:—

"We have the ships, we have the men,
We have the money too." (Cheers.)

That is an advantage of which we have availed ourselves to an immense extent—an advantage thrown into our lap by the errors committed by our neighbours, which we say they were most welcome to commit.

With all this vast amount of shipping there must always be an anxiety regarding the men, and, no doubt, there is a too large proportion of foreigners in our Merchant Navy. That cannot be helped. They are, many of them, excellent men, especially if they be Germans or Scandinavians; but still this proportion is a matter of concern, and the moral of it is that England ought to pay more attention than she does to her fisheries. I recollect that there was a Fishery Exhibition in London, and a wonderful paper—the best paper that ever was written upon the fishers and fisheries of England, composed by the Duke of Edinburgh—was read to the meeting by the Prince of Wales. I say that this subject ought to be much attended to by all those who are interested in the success of our maritime resources—the fishermen, the fisheries, and the fishing—because there is every reason to believe that, owing to steam trawling and other causes into which I cannot enter here, many kinds of fisheries are being superseded or exhausted, and that the fishermen are not so numerous as they might be, and as they ought to be. Constant complaints are made, not only in Parliament, regarding the extinction of many of the fisheries in Scotland, in the fiords and arms of the sea that run into the coast of Scotland. These considerations are all most serious, because they affect the supply of men for our Merchant Navy, and ultimately, of course, for the Royal Navy also.

Another point in reference to our maritime resources is the ship-building yards. There we have an enormous advantage over all other nations. We have ship-building yards much more extensive, better organised, more numerous than any other nation, and that, of course,

gives us an infinite power of building ships-of-war rapidly. It is very well for a French Government, for example, to lay down a naval programme. Have they the means of carrying it out in due time? Now, we say we will lay down any naval programme which can be reasonably conceived, and we have the power if we choose to carry it out. It is only a question of Parliament voting the money, and the thing can be done. (Cheers.) There are the Government yards, which are most important to maintain, because thereby you have a large body of skilled artisans who are outside trade organisations and who never strike. But besides these, it is most important to see to the great outside ship-building yards, which can supply *ad libitum* any number of ships which we require by means of private enterprise. We should be thankful for the advantage, and study its conditions accordingly.

With reference to ship-building, I would urge upon the attention of British officers the importance of having what is called a quinquennial financial plan. You can realise what that means. A certain sum is appropriated by Act of Parliament for ship-building, to be expended over a period of years—a sum set apart and to be drawn upon by the Admiralty authorities, according to their requirements. That is an enormous advantage from a ship-building point of view, because you have a sum to draw upon; there is no undue haste to get a thing done in one year, no undue delay by getting it done in another year. Everything goes like clockwork, regularly, according to the designs of the naval architect, and according to the Admiralty plans with reference to the naval programme. Believe me, that is a great benefit to all those who are concerned in ship-building.

Well then, we have this other point of commerce-destroying, and the protection of the ocean highways. Commerce-destroying is a phrase I borrow from Captain Mahan's book. You realise what that would mean in an Empire like ours if you come to consider the ocean highways. The ocean is permeated by highways just as the land is permeated by railways, and if you consider them in all their length and variety, you will see that the defence of them is really impossible. If we were to build cruisers innumerable, we could hardly ever protect them all. Of course, we may arrange for arming civilian vessels, like the Atlantic racers and so on, but still, I submit after all, from a political point of view, the great thing is to have sufficient battle-ships in waters near home—ships, too, inured to the stress of the Atlantic—and thus superior to ships that are not exercised beyond the Baltic, the Black Sea, or the Mediterranean. I put to you the analogy of a tiger—a tiger attacking me as a sportsman. He has got his teeth on my shoulder and his claws on my legs; but if somebody will just put a bullet through the brain, then the teeth here will relax, and so will the claws down there. That is the analogy. If our naval enemy is defeated, blown out of the water in the Mediterranean, or in the Channel, you may depend upon it his arrangements for commerce-destroying in the Atlantic or Pacific, or elsewhere, will speedily collapse. (Cheers.)

But now, if we have a preponderance of ships—I will not assume for a moment in an address like this to dwell upon the comparison of the naval forces of various countries—assuming that we have a superiority of

more than two to one over any other Power, or even a force equal to any naval combination that could reasonably be brought against us—supposing there were to be a review of the fleets of all Europe in the Bay of Biscay, and you put the British line on one side and the combined line of all the other Powers on the other—and I believe the British line would make a show that would make the pulse of every Englishman beat high—supposing all that occurred, still there is this difficulty, the maintaining an adequate number of men for our mighty fleets in every part of the world. (Hear, hear.) There is this difficulty, I say, that whereas other Powers have their maritime conscription, and have their men at home and ready, our possible seamen are scattered all over the globe. That has happened more than once at the outbreak of war. We could not get our seamen in, or, rather, we could not get the men home from whom we hoped to man our Navy, whereas our rivals had all their men at home. Thus there must be always this danger or difficulty, and I submit that we have never taken sufficient care about the organisation of our Naval Reserves. Surely we ought to have as much mobilising power as possible within the four seas of Great Britain—we will say the United Kingdom. We ought to have a large body of sailors—men all of whom would be available at the instant for manning our ships—just as we have our Army Reserve. No doubt this is done to some extent, but nobody acquainted with the conditions of the British Navy believes that we have any such arrangement organised in a sufficient degree.

Well then, the question arises as to the defence of our naval ports. May I be forgiven for saying that that defence must be undertaken by the Army alone, and not at all by the Navy. Every ship of war we have is wanted to put out to sea at a moment's notice, and attack the enemy. It cannot be kept for defensive purposes in the ports. (Hear, hear.) I lay down that, although I am only a civilian, and I say it is borne out by the whole of our naval history. We have always taken the offensive at sea. However superior the enemy's Navy may have been in force over us, we have always stood on the offensive, and we have always been the attacking party. That gives us a tremendous moral force. You recollect the famous case of Nelson, who left the station that he was ordered to guard because, he said, he was bound to pursue "his fleet," as he called the enemy's fleet. That was his fleet, in his grasp, and he was bound to follow it up to its destruction. The enemy resented, no doubt, his calling it "his fleet"; but that is a noble instance of the spirit of the British Navy. Therefore, the defence must be superseded by the attack.

I will not touch upon the defence of our naval ports at home, but I will only assure you our great naval ports in the East are not defenceless. Take Calcutta. All you need to do there is to let the enemy attempt to approach, to withdraw your buoys and your pilots, and let him sink in his own quicksands. You might even stand and watch him as he sinks, in the hope of saving the poor drowning enemy before his ships shall vanish in the sands for ever. The same with Bombay. An enemy may approach Bombay—what would he see? The mercantile fleets of the East are not in the harbour at all; they have gone far back behind the rocky island of

Elephanta. He would see nothing except a few black spots representing ironclads. In the meantime batteries from behind earthen breast-works would blaze upon him all round. In the same way Kurrachee and Rangoon are most difficult ports for an enemy to approach.

So much, then, for our power of fighting by sea. May I draw your attention now to our resources for fighting by land? Now, you may be aware that there is much civilian apprehension lest in this country we do not get enough fighting strength for the money we spend. That is really one of those problems which no English politician has ever been able to fathom; but, nevertheless, I would warn all my military friends that there is a very grave apprehension pervading all Parliamentary circles; and I imagine there is no study more fruitful to British officers than to examine the military finances of foreign Powers, to find out how it is that they do manage to get more army corps in proportion to the millions of money they spend than we do. However, that is a most difficult subject which it is impossible to dwell upon in a summary like the present. But I would ask of my military friends never to be parties to disparaging the military strength of the British Empire (hear, hear), because, after all, the respect in which we differ from the great military Powers of the Continent is this, that they have got all their forces at home; we have got ours scattered all over the globe. Why, gentlemen, if you count up the Regulars at home, the Reserves, the Militia, the Yeomanry, and Volunteers, also the armies in India, European and native, and the organised forces of native Indian princes, then the Australian, Cape, and Canadian Volunteers and Militia, you will find the total comes up to a Peace Establishment of one million of men under arms and bearing allegiance to the British Queen-Empress, and that is undoubtedly a respectable military force, according to any European standard. (Cheers.) I need not say the quality of the men, taking them all round, is fully equal to that of any armies in the world. (Cheers.) Remember, we are the only Power that can maintain a large body of troops thousands of miles away from home. We sustain on the average 100,000 men of our own flesh and blood thousands of miles away from home across the ocean. That is an effort to which no other military Power is equal. It is an effort that would exhaust France, Germany, Russia—any Power you may name—and, therefore, in that respect I am entitled to claim for my country that she is not only a great military Power, but that she is unique and she can achieve military feats unknown in any other nation at any period of the world. (Cheers.) And I would invite your consideration of the remark made by the great military historian, Sir William Napier, as to the moral disadvantages to which we subject ourselves by the too constant depreciation of our military power.

These great forces have this peculiarity—they are all from voluntary enlistment. That is also unique—a perfectly unexampled situation in the history of the armies of all nations at all times. But not only this; do you realise that the quarter of these million of men enter into the British Services not upon any question of long service or short service, but for life, with the intention to remain under the colours all the active years of

their lives in the hope of a retiring pension for old age? In what other armies has such a thing ever been heard of?—yet it is the proud boast of the armies that serve the British Queen.

Now, this voluntary system of ours has one great advantage over conscription, which is this, with a scattered Empire like ours, and the men enlisting upon the voluntary system, they go cheerfully anywhere. No complication arises—they go anywhere, and stay as long as they are required, and there is no complaining; they take it as part of their patriotic contract. Other nations cannot do that with the conscription system. The French or Germans would not tolerate that their conscript soldiers should be kept for any long time in Madagascar or South Africa, or anywhere else. Therefore, please consider that we are, by our voluntary system, the only Power that can maintain its Empire by military force. We are the only nation that can afford to keep a large body of men in voluntary obedience to their orders and in allegiance to their colours for any long time beyond the seas. What follows? We are, by our system, the only Power that can have a great Empire. Other nations may establish a sort of Empire in name or on paper. We are the only Power that can maintain an Empire by force of arms, and I need not say, however much it may incur the condemnation of those who call themselves philanthropic men, it is upon force ultimately that the basis of foreign power must depend. (Cheers.)

Then, might I draw the attention of all British officers to the condition of the labour market at home? Believe me that success or ill-success as to enlisting men is more a civil question than a military one. Our officers should be intimately versed in all the conditions of the labour market, in all the causes that render men willing to enlist, all the causes that make employment slack, and, above all, to the rates and wages, advantages, and emoluments which can be earned in civil employ, and, consequently, proper determination as to what the British Government must offer if it is to raise from 30,000 to 40,000 recruits every year. Those questions are of a highly economical and civil character, but, nevertheless, they have to be studied minutely by military men.

Then I need hardly observe that every means should be studied for improving the lot of the soldier—not only his material comfort in barracks, but everything that may humanise, elevate, make his life agreeable, and give an impression to the public of the real truth, which is simply this: that the lot of a soldier now is about one of the best lots which a labouring man, a working man, can hope to attain. (Cheers.)

And then, surely, we ought to pay enormous attention to everything that relates to gun making. It is the power of manufacturing guns that greatly sustains our Empire. I speak in the presence of some of the greatest authorities, but, I presume now, it is earthen breastwork of the best form which offers the best defence; that nothing so readily resists the shot of the enemy. If this be so, then what a power it places in our hands! We can make any number of guns; we can transport them anywhere; having a command of labour for earthwork we can place them behind the breastworks, and in a short time we can provide the most tremendous batteries.

Well now, this point exhausts what I have to say regarding the resources of our power by sea and by land. May I, before I conclude this part of the subject, touch upon two topics? First, the girdle of our naval stations round the globe. That is a strong expression to use, but a moment's thought will show you that it is justified. You begin with Gibraltar, which holds the keys of the Mediterranean; Malta, guarding the approaches to Egypt; Aden, commanding the gate to the Red Sea. Mark you, three of the most important strategic positions on the earth are the Cape, Gibraltar, and Aden, and they are all three fortified stations of England. From Aden, the gate of the Red Sea, you run across to Ceylon, thence to Singapore, and the Straits of Malacca; then to Hong Kong, commanding the approach to the Chinese Sea. Then you run down to Thursday Island, a fortified station commanding the straits between New Guinea and Australia; then round to King George's Sound, at the extremity of Western Australia; then to the Mauritius; then to the Cape; then up to Sierra Leone; then to San Lucia, in the centre of that girdle of islands that surround the Carribean Sea and the Gulf of Mexico; then down by the Falkland Islands to Vancouver's Island. There is one place only deficient, namely, some one of the islands in the Central Pacific; but with that exception no important place on earth is left untouched by England. So we get to Vancouver, and Vancouver is what? Why, gentlemen, it is the back window of our house from which England looks out across the Pacific towards the Eastern Empire. On the other side is Halifax, from which she looks out at the front window across the Atlantic homeward. So, therefore, I am justified in saying that we have got a girdle of fortified military stations right round the habitable globe. (Cheers.)

One word, before I finish with this part of the subject, about coast surveys and land transport. Now, sometime ago, there was an inquiry made about the coast surveys of the world, owing to various losses sustained by the British Navy. Since then, much has been done, but even in some of those portions of the world which were supposed to be well surveyed there have been grave losses of British ships. That is a most serious subject for the consideration of British officers. I say that the topography and geography of the coasts of the world is one of the first subjects of study to those who wish to be accomplished in their profession. Accidents are happening even daily—naval accidents—owing to the insufficiency of these surveys.

And then about transport. As to transport service, our position is essentially different to that of any other nation. A French transport officer has to deal with wagons and horses and transport familiar to Europe; so does the German; so does the Russian. An English transport officer is in a different position. Our wars may happen—they will not happen in Europe—we know not where, we know not when, under what conditions, under what skies, under what circumstances, or in what part of the world. Our transport officers ought to be peculiarly skilled, with a world-wide knowledge of transport resources. They ought to be so organised that they shall travel all round distant countries and

learn what the means of transport are. They have to be learned not alone in horses and wagons, but in elephants, in camels, in buffaloes, in mules and hill ponies, in pack bullocks, and they have to understand what are the conditions under which these various animals can work, both climatically and economically. And, moreover, they have to study peculiarly the gear. Believe me, as a man of some experience in this matter, more accidents to our transport happen from faults of the gear than from any other cause. I say British officers ought to be most attentive to everything that shall make transport gear work smoothly in active service.

Well now, gentlemen, this completes Part I.—the "material" part of my subject. Let me conclude by a few words upon the second part—"the moral and personal."

Upon that I may be more brief than I have been able to be on the "material"; but the first thing I should like to mention is the question of "tradition." I once heard a leading politician, who was rather a "peace-at-any-price man," say that "England might well be economical about her Army and her Navy because she had undying tradition to depend upon." A more deadly, dangerous doctrine could not possibly be preached. (Cheers.) You think the quality and courage and nerve of men do not alter. True; but war depends upon other things besides—it depends on organisation and preparation and command. These may vary in the most fatal degree. Who could have believed that the forces of Prussia, so organised by Frederick the Great up to the third quarter of the eighteenth century, would be shattered in the early years of the nineteenth century, within a quarter of a century, or one generation? Nevertheless, was it not so both at Jena and at Auerstaedt? It is said at Jena the Prussians were overwhelmed by superior forces. It was not so at Auerstaedt—I know the ground—where 35,000 French beat 70,000 Prussians, successors of the troops of Frederick the Great. This happened, mark you, for the example of Englishmen, not to people of the Latin race or the Slav race, but to Teutons, men of the same flesh and blood with ourselves. And what happened to Prussia might happen to us. Well then, I put it to naval men, if you study exactly the events of the second American war, the one that happened soon after the Napoleonic wars, and look how many mishaps there were, British frigate after frigate being taken by American frigates; yet these were perhaps some of the very ships which had fought under Nelson, and all these examples happened within a few years of the long series of triumphs which culminated in Trafalgar. How thankful we were when all these little petty disgraces were wiped out by the crowning triumph of the "Shannon" over the "Chesapeake"; but what a lesson that is of how easily the most glorious traditions are broken either by sea or by land!

The next point I wish to impress upon you is the importance of preserving independent individuality. Now, my friends, this is a quality which is the birthright of every Britain, at home and abroad, especially under desperate difficulties and solitude, in foreign, half-civilised countries. No quality is so characteristic of us as that, and it is that quality in which we surpass all other nations, and to which we largely

owe our Empire. Yet, nevertheless, there is an impression that, although this quality must, of course, be shared equally—more than equally by our military men—yet our military system has tended to lessen or weaken that quality. I believe the importance of it is recognised now much more than it used to be. But remember, that although our operations by land will become more and more scientific and recondite, in a certain sense, nevertheless, they will have this effect, that men will have to act singly, or in very small bodies—twos and threes—much more than they have ever done before; and I understand the Germans are, especially, drilling their men for this purpose. We must have that surely, at least in an equal degree. We need it even more, because with us a regiment is a great unit, far more than any other nation. A company of troops is an appreciable unit; even a squadron is a unit; even an individual man is a unit in the British Service, owing to the exigencies of the Service itself. Well then, surely this is the quality of qualities which we ought to foster, and the more that is studied by our Army men, the more it will conduce to the safety of our Empire.

And there is another thing which I may remind you of. People will suppose, of course, with all of these arms of precision, and firing at immense distances, fighting, so to speak, with long bows, that there will not be the same requirement that there once was for the ugly rush, the storm, the charge, and so forth. Well now, about that, may I mention one thing that has come under my own knowledge? I have studied all the dioramas of which the Germans are very fond, as exhibiting all the principal battles in the late war. I take it, these dioramas are prepared by military authorities, and they represent that which the German authorities wish to show to the fighting men of their nation. All these dioramas display the rush and the dash exactly as it used to be in old times, proving that, in German opinion, all the same qualities that make a man charge well and fight well at the very closest quarters are as much wanted as ever. That I mention for what it is worth, but it affords the remarkable evidence of German opinion.

May I give one illustration of the importance of individuality from our naval history? Have you ever studied James's account of the battle of Trafalgar? It appears that as soon as Nelson, by immense skill, had really got the enemy's fleet within his grasp, and had directed his attack by two columns, he sent an order to his subordinates that as soon as they got the general orders they were to fight as they best could for their own hand, so that as soon as the essentially general attack had been delivered the rest of the battle was fought ship by ship; every ship did the best to engage the nearest enemy, and to help every sister ship in danger; this was a sailor's battle and a ship's battle, ship by ship. If that is true, as I understand it is from the best naval history, is not that a splendid example of the advantage of the independent individuality which characterises the British fighting man? (Cheers.)

One word about physical geography. It follows—does it not?—from such a history as that which I have described that our officers should be masters of this branch of science. They must thoroughly understand

how mountains affect a climate, how from the mountains arise rivers, how from the rivers come the valleys, which afford the best means of advancing; in fact, how the contour of the land in divers parts of the world will either impede or facilitate military movements. And combined with all these forms of land there are all the varieties of climate as affecting military life in the field. There is an immense field for study, which it is extremely necessary that British officers should explore. It is so vast that I fear our younger officers would feel appalled at the idea of undertaking it; but, more or less, this will have to be undertaken by every British officer who aspires to be accomplished in his noble profession.

In the same way a sketching power is most important. An officer who has not only an eye for country, but can make a good intelligent sketch rapidly (I will not say an artistic sketch), which he can knock off while in the saddle so as to exhibit it to his superior officers, accomplishes a most useful step in the work that is in hand.

There is but one more topic to which I will briefly allude, and it is this, that presence of mind, under all difficulties, is a quality that is partly born in a man, no doubt; but, believe me, there is no quality which is so open to be acquired. It can hardly be possessed perfectly by an unprepared or an ignorant man. It will be possessed by almost every Englishman who cultivates it, and it can only be cultivated by constantly keeping before his mind all the various forms which danger may assume. A man should think, wherever he is, in whatever quarter of the world, "what are the kind of dangers which, in this climate, in these surroundings, in this geography or topography, and in these barbarous tribes around me, under all these environments, what are the dangers that might easily happen?"—think exactly how they would come about and what he should do in such an event. I say that a man who has constantly thought these things out, has habituated his mind and his reflections to them, will act immediately, as a matter of course, the moment the eventuality arises. It is the principle which has been followed out by the "first aid" to the wounded or to those who suffer from accidents. Why, the most skilful man, the bravest man with the readiest presence of mind, will not know what to do if he suddenly sees a case of imminent death before him unless he has been already trained as to what he ought to do. That is a thing which is thoroughly understood now by the instruction given in first aid to wounded; the commonest persons are taught what to do in those grave emergencies when life and death hang upon instant action. That is, of course, in a humble way, an illustration of the theory which I venture to propound in order to make British officers experts in emergency.

And now, Field-Marshal and gentlemen, I hope I have not unduly detained you. (Cheers.) I hope that I may be excused if I seem to have treated inadequately many of the tremendous topics which I have had to bring before you, but really it is the magnitude and comprehensiveness of my subject which must serve as the excuse for my shortcomings. And, gentlemen, believe me, as I resume my seat, that though I have no doubt been all my life in the civil service of the

Crown, yet I have had a great deal to do with military matters. (Hear, hear.) Many of my best and most active efforts have been spent in the society of men of the Army and Navy. I have had much concern with what is called military administration, and also with active service and transport, and I can fairly say that I love and honour your most honourable and noble profession almost as much as you love and honour it yourselves; and that, although no doubt the burden of my song this afternoon has mainly related to danger and to difficulty, yet I believe in the truth of the old Latin phrase, which we learnt from our boyhood, *Nil mortalibus arduum*, which, translated into the nineteenth-century language of the day means this, that there is no danger, no difficulty, too arduous to be surmounted by British energy, British foresight, and British resolution. (Loud cheers.)

The CHAIRMAN: My lords, ladies, and gentlemen,—I am sure that you will render to Sir Richard Temple a hearty vote of thanks for the most interesting address which he has given us. It is an Inaugural Address, the first that has been spoken in this theatre, and one which will give a vast amount of ground for reflection to all who have heard it. He has gone through a number of subjects such as are not treated customarily in this Institution. We confine ourselves very much to details of the branches of the profession to which we belong, but the large questions which Sir Richard Temple has brought to our notice are really some of the very highest importance, and which both soldiers and sailors are bound to study if they wish to arrive at high command, and to maintain the honour of their country and the integrity of the Empire. (Cheers.) It would be useless for me, in fact, I could not attempt to touch upon any of the great topics which he has brought before us, but I think that I may say, and say safely, that this address is one which ought to have an effect on the whole profession (hear, hear), not only on us who are here, but on the whole profession; and I will go a step further, it ought to cause reflection, if they read it or have heard it, to the best statesmen in the country. (Hear, hear.) He has touched the whole Empire, from one end of it to the other, throughout the world; has pointed out to us our strength, and has touched also upon our weakness; but I think with him that it would be a great matter if we soldiers and others, and sailors also, did not run down the power of this country, as is too much the case, in our public documents and public prints. (Cheers.) There is a vast amount of latent strength in this country. There are great faults in our organisation no doubt, very great faults in all parts of the world, and defects that ought to be remedied; but I do not think myself that it is a wise thing for professional men to be always denouncing the Army or the strength of the Empire. (Hear, hear.) I think the advice Sir Richard Temple has given us in that respect is sound. It is unnecessary for me to say more, but I am sure I may convey to him the unanimous thanks of all present for the very valuable and interesting address which he has so kindly given to us. (Cheers.)

Sir RICHARD TEMPLE: Field-Marshal and gentlemen,—I must not now detain you at all with another speech. I will only say how highly honoured I am by the approbation which has been conveyed to me through your very distinguished Vice-President, and which has been so cordially applauded by you. But I would not claim any credit from you for myself. If you are inclined to give it to anyone I would claim it for the great national representative assembly—the Commons of England—to which I have the honour to belong. (Cheers.)

Wednesday, March 13th, 1895.

Colonel J. F. MAURICE, R.A., C.B., in the Chair.

The CHAIRMAN: Before asking Surgeon-Lieut-Colonel Douglas to give us his lecture, I wish to say a few more words than are generally necessary in introducing a lecturer here, because it is not very obvious to those who do not know Dr. Douglas—though I fancy a good many of you who are present do know him pretty well—why it should be particularly the *métier* of a doctor to deal with the subject of boats for the transport of troops. It so happens that I have spent many days and hours with Dr. Douglas during a time when certainly, if it was not representative of a large portion of his life, I may almost say of him, in the sense in which Charles Lamb said of that wonderful old lady of his who devoted her energies to the game of whist and relaxed her mind afterwards over a book, that I think he used rather to relax his mind over—I do not say it at all in disparagement of his professional ability, which was then very valuable to me—but he rather relaxed himself over his medical work, and his whole soul was devoted to the very charming fleet of boats which he had, of all sorts and descriptions: birch-bark canoes, paper canoes, sailing boats and others, almost all of them made largely on his own design, and worked most admirably by himself. And, furthermore, though that experience covers a period of twenty years—and I have known him during all that time and ever since, expending all his time and interest on such aquatic business—I may refer to a yet earlier period of his life as showing the same predilection, for the fact that he holds the most coveted distinction which any soldier can hold is due also to one of the most brilliant aquatic performances that is recorded in the annals of the Victoria Cross. Though that is no proof of his capacity for invention, it does represent a very large experience, both in the construction of boats and in their practical working, so that he has dealt with the matter on both sides to an extent that can scarcely be said of anyone else with whom I am acquainted. I therefore think I shall not be calling upon one who will not speak with authority in asking Dr. Douglas to deliver the lecture which he is about to give us.

ON THE MOST RECENT DEVELOPMENTS FOR CROSSING RIVERS AND LANDING TROOPS.

By Surg-Lieut-Col. C. M. DOUGLAS, V.C., A.M.S.

IN taking up a subject which is altogether unconnected with my profession, perhaps the old saying of the "shoemaker and his last" may occur to you.

Ne sutor ultra crepidam, what may a doctor know of subjects which belong to the province of the sailor and the engineer? But a fellow-worker in the same field as myself, to whom, indeed, I am indebted for some points in connection with the folding-boat, is a clergyman; and our great philosopher has asserted that new inventions or improvements are nearly always made by outsiders, who are untrammelled by the tradition and grooves of the regular profession—who have a mind clear of bias to consider the problems they have taken up. If, however, what I am about to say is trite and well known, I hope you will bear with me, in the belief that I have the will, if not the power, to help in a useful and important work.

A great scientist, who died not very long ago, has told us that "heat" is a "mode of motion." "War," which is essentially "heat," is also a "mode of motion"; and of the various obstacles to military movement water is one of the most important, whether it is in the form of river, lake, or branch of the sea.

To overcome this obstacle many means are employed and have been suggested, "boats" being, of course, in the first place.

I wish to direct your attention to two kinds of boats, which may be found especially adapted for naval and military work—a folding-boat, the idea and the application of which are taken from the old hide boat, or "coracle," and a flat boat, which is well adapted for being "nested," or fitted one inside the other for the boat service of large vessels, or divided into sections, and nested, for facility of transport, for pontoon bridges, or bridges of boats. Let us take the "folding-coracle" first.

I show you here the models of two varieties of the old hide boats, which still survive in the British Isles—the "curragh," which is used on the West Coast of Ireland, and the "coracle," in which the fishermen of the Dee, the Wye, and the Severn ply their vocation.

Canvas is now used instead of the hide ("corium," from which the name of curragh, or coracle, is derived); otherwise, the style and model of the boats are probably identical with those which were used by the Ancient Britons, and by other nations 1,000 years ago. You may judge from these models that they are rough and clumsy-looking, but they have advantages which are not possessed by many other boats, and which have caused them to be retained and used by the men who know them and appreciate their merits for certain purposes. They are light for their dimensions. The curraghs, in spite of what is said to the contrary by those who have, perhaps, but a faint idea of the distinction between a curragh and a coal-scuttle, are excellent sea boats; they are capable of being easily beached and carried by their crew, easily repaired, and unaffected by exposure to sun or moisture. The coracle is more of a river boat, very much smaller and lighter than the curragh, but it has much in common with it. It is usually propelled, however, by a paddle instead of by sculls or sail, as the curragh is.

For military purposes the hide boats have been used from a very early date. In his biography of Cæsar, Mr. Froude records how this famous general enabled his soldiers to cross the River Segre, in the north of Spain:—"The melting snows in the mountains had brought a flood down the Segre. The situation was most critical; even Cæsar's own soldiers became unsteady. He remarks that in civil wars men show less composure than in ordinary campaigns. He had observed that in Britain, the fishermen used boats made of wicker covered with skins. The river banks were fringed with willows. There were hides in abundance on the carcasses of the animals in camp. Swiftly, in these vessels, the swollen waters of the Segre were crossed and the convoys were rescued."

Later, the old chroniclers, Froissard and Hollingshead, mention the use of coracles; how, in the French wars of Edward III. and Henry V. of

England, they were taken over to France by ship to enable the soldiers to pass the waters which might be in their way on their marches. These "Naisselles" were "artfully made with boiled leather,"[1] and I presume were something like the boats of which this (*i.e.*, the Welsh coracle) is a model.

Many light portable or folding-boats have been tried in modern times in England, but few, with the exception of Mr. Berthon's collapsible boat, have come into use.

I have attempted to simplify the folding-boat, and have designed the little craft which I show you, the idea of which is taken partly from the Indian birch-bark canoe and partly from the coracle. It is, as you see, extremely simple, except at the stem and stern-posts, where the two gunwales are hinged, otherwise no hinges enter into the design. Stout ribs distend the boat, these ribs being hooked under the gunwales and kept in position by blocks on the keelson and cleats on the under surface of the flooring-board.

These boats are built after two models: in imitation of the coracle, with comparatively great beam in proportion to length; and like an Esquimaux's "kyack," narrow for the length of the boat, decked with waterproof cloth, and intended to be propelled by a double-bladed paddle. This latter form is well-adapted for a picket boat, a number of them could be carried on board a steam launch and stationed about the mouth of a harbour, or where danger might be apprehended from the sudden dash of an armed cruiser or torpedo-boat. They would be manned, each by one man, provided with some means of signalling, such as a flash light or pistol. Thus, a considerable extent of water could be covered without an increase in the number of men required, as would be the case if ordinary boats manned by four men, at least, were used. They would, in fact, be like a chain of sentries round a camp on land, and would render it difficult for an enemy's vessel to pass unobserved on a dark or foggy night, or surprise a ship at anchor and unprepared to resist an attack. These "kyacks" would be provided with cork or reindeer-hair belts to render them unsinkable, and as "look-out" boats for coast defence they would be useful. The signals would be transmitted from boat to boat to the shore or to the vessel likely to be endangered. In designing folding-boats, the points to be aimed at are: safety, simplicity in working, and the production of a light, convenient package which can be easily carried. Many hinges are a drawback; they cost money to put in, they are liable to jam, to break, and render the boat useless when most required. For carriage on a pack-saddle by a led horse it is not advisable that a length of 10 feet should be exceeded. This I ascertained by experimenting on a "dummy" horse as to the best way they could be stowed.

The canvas skin is protected by longitudinal battens of hard wood, which stiffen the sides and prevent chafing. I have given this boat a thorough trial, under various conditions, on the waters of India, the North-

[1] "Faittee s'y soubtill ment de cuir boully."

West Province of Canada and Ontario, and the United States, and also on the sea and rivers of England. I may mention, perhaps, that I crossed the English Channel from Dover to Calais, on the 19th June last, in one of these boats, and I have found it a very reliable and efficient one—although small, it is strong, durable, and buoyant. To add to its buoyancy and render it unsinkable in case of accident, bolsters or belts of reindeer hair are attached to its sides. These are quite superfluous, I am convinced, for ordinary river work, but when the boat is used on the sea it is advisable sometimes to have them. Like the revolver which is carried in Texas, you may not want them, but if you do, you want them "bad."

For naval and military purposes, the uses to which a good folding-boat can be put are many and various. It can be used to supplement the boat service of vessels, especially in craft on board of which ordinary boats can be carried with difficulty owing to the want of stowage room, as in small torpedo boats, steam launches, etc. When a boat is required quickly, a small folding-boat which can be got out in a few moments and lowered without the necessity of employing tackle would often be of the greatest service. As tenders to small launches to enable them to communicate with shore in case of a breakdown of machinery, or when a sloping beach or the state of the tide prevents even a launch approaching shore without the risk of grounding. As scouting boats they would be very useful. An instance has recently occurred on the west coast of Africa illustrative of this. A steam launch, proceeding up a river, was fired into from an ambush, and some of those on board killed or wounded. The engine was stopped, and but for the pluck of the engineer, who, though severely wounded, managed to set the engines going again, might have been entirely destroyed. Now, had two or three scouting canoes, half-a-dozen of which might easily have been carried by the launch, been sent on ahead when there was reason to suspect danger, the ambush would probably have been discovered with little or no loss of life. As a light and convenient tender and scouting-boat the folding-boat fills a decided want.

For military purposes, a light folding-boat which can be easily carried would often be of the greatest service in cases when rivers have to be crossed—a matter of great importance—and we know that the passage of certain rivers occupies a prominent place in history. For scouting, for reconnoitring a position by water, for ferrying over men and ammunition, and establishing communication between bodies of men on the opposite sides of rivers, folding-boats could be used with the greatest advantage. Take a case which occurred in South Africa last year, when, owing to the rising of a river, a small force of about thirty men were cut off from the main body on the opposite bank, and entirely destroyed by the natives. A few light folding-boats, which would have encumbered the transport but very little, might probably have prevented this disaster.

The boat can be used as a sort of flying-bridge to enable a mounted body of men to cross a river by driving in a stake on the opposite bank, attaching a pulley to this, through which an endless rope might be rove.

The men could be ferried across with their accoutrements, while the horses could cross by swimming. Small bodies of men might also be ferried across a river in this way, or a number of boats could be attached to a hawser stretched between the banks, and a light footway quickly laid upon it, to enable infantry in light order to cross a river readily, and relieve the pressure upon a regular bridge. When in camp, the boat can also be used as a shelter tent, as the American Indian uses his birch-bark canoe.

I may, perhaps, again bring in my personal experience in the Riel affair of 1885, in the N.W. of Canada. I made a cruise down the South Saskatchewan River of some 220 miles, travelling at the rate of about 45 miles a day on an average, carrying a fortnight's provisions, and sleeping under my canoe at night. The canoe was a folding one 12 feet in length by 2 feet 6 inches beam. It is the same one in which I afterwards crossed the English Channel.

For river work, a paddle should be used instead of sculls or oars; the saving of weight and "duffle," when thwarts, sculls, and rowlocks are dispensed with, and a light paddle carried in their place, is considerable. The paddler works in the direction in which he is going, which is often a very great advantage. He can utilise an eddy with more effect than if he were rowing, and can see better than by looking over his left shoulder. The sizes that will be found most convenient will probably be 8 and 10 feet long by 3 feet 6 inches wide, weighing respectively from 35 to 45 or 50 lbs., according to the thickness of the canvas used.

These boats will not, of course, carry more than two or three men each, with their accoutrements. When rather a large body of men have to be transported across a river, it would be better to increase the number of boats than to increase the size of them. Large folding-boats, I am convinced, are a mistake; they are difficult to handle and set up and down, and the advantages are not commensurate with the trouble they involve.

Beyond a certain size, both for the boat service of vessels and for bridges, when a large number of boats are required and it is necessary to pack them in a small space, flat boats which can be "nested," or fitted one inside the other, deserve notice. The boats, which are known in America in various localities as "batteaux," "dories," "sharpies," and so forth, deserve more attention than they receive on this side of the Atlantic. I show you here a couple of models of flat boats designed for the boat service of transport and passenger vessels. The model is taken from that of the "dory," or small fishing boat, used by the schooners on the East Coast of America, but it is the model of a much larger boat. The "dories" usually employed are too small to carry more than a very few passengers.

These "dories" have been used, I suppose, for a great number of years by the fishing schooners. They are fitted one inside the other in "nests," or groups of three, so that the three boats can be carried in the space of one. The boats recommended for ships' use are, as you see, flat, or nearly so, with an angular "bilge," and without any keel to interfere

with their being packed one inside the other. The advantages of this kind of boat are, that it has great buoyancy and carrying capacity, light draught, and is a very strong, cheap boat to build. Unlike the ordinary ships' boats, built in the usual way with a round "bilge," it does not depend to the same extent on its thwarts for its stiffness—a great point to be considered, when the thwarts must be made removable, as they must be in nested boats.

It would be advisable to have a separate tackle for each boat, so that no time would be lost in lowering. Comparatively small ships' boats (by which I mean boats of from 20 to 25 feet in length by 4 feet 6 inches to 5 feet 6 inches beam) are preferable to large cutters of 30 feet by 8 feet. They are more easily handled, their freight can be stowed more rapidly, and they offer more chances of escape, on the principle of not putting too many eggs in one basket.

The "dories" used by the American fishing schooners are quite small boats, about 16 feet in length by 4 feet beam, and even less. But these little boats are rarely swamped; and it has frequently happened that when, owing to fog or other cause, the crew of the dory have been unable to rejoin their schooner, the boat has been picked up afterwards with the dead bodies of the men on board, who have perished from cold and exhaustion, while the dory has survived the waves. The Atlantic has also been crossed successfully in these boats.

For landing troops, boats of this model would be very useful. Their extremely light draught would enable them to be easily beached on a shallow, shelving coast, or bay. Provided with small double keels, they would take the ground easily, and would not be bilged by the weight of men in them when they grounded. They are also comparatively light for their size.

Here I show a model of another boat, made in sections for a bridge of boats. This boat is flatter and shallower, and is made so as to be easily packed in transport wagons; it is divided amidships, and the sections are nested one inside the other. It is a strong and simple boat, and could be used with great advantage when a strong temporary bridge has to be thrown across a river; the advantage of boats over pontoons being that they can be put in position by the men on board them instead of being towed, and moored or fastened to a hawser by men in other boats.

It may be advisable to notice some of the folding-boats, or substitutes for boats, used by Continental nations.

The Russian engineers use a canvas folding-boat which opens and shuts something on the principle of an accordion. From what I could gather, and from what I know of such boats, which have been long in use in the United States, they have many defects, and are only capable of a limited application to military purposes.

A boat made of reindeer hair in a canvas covering was shown in the German section at the Columbian Exhibition; this boat is, I believe, now being tried in England. It is more of a raft than a boat, is very buoyant and unsinkable, but very slow and awkward to handle. I do not

think it is adapted for river work, it occupies too much space when folded, and cannot be worked in a current.

A sort of float has been made with the waterproof flooring of tents, and has been used to ferry over arms and ammunition, the men swimming across. This idea first occurred apparently to Dr. Nansen, the celebrated Arctic traveller, who made a boat, or what the Esquimaux called a half-boat, out of the flooring of his tent, with the sticks of a theodolite and such wood as he could collect, on his reaching the west coast of Greenland, after his journey across the inland ice.

Bundles of straw and cornstalks have also been used for a makeshift bridge, and in the absence of portable boats this appliance might be of service. Recently, I saw in one of the Service papers a notice of a folding-boat made in France of boards and canvas, 8 feet long and 3 feet 4 inches wide, weight, $1\frac{3}{4}$ cwt. with gear. It was said to be capable of ferrying over eight men, with accoutrements, at a time, or, to give a rough estimate, 13 to 14 cwt.! What this remarkable boat can be like, and what its draught may be when loaded, are not mentioned; it must be as unique as Noah's Ark, and of proportionate carrying capacity.

That there are difficulties in the way of introducing these boats, even so far as to get a trial for them, must be admitted. The inventor, even of so small a design as this—the man with a new idea, which he desires to introduce—is looked upon as a nuisance to be suppressed. He has the task of a Sisyphus, trying to roll his stone up the hill of prejudice. He is blocked by official documents which stop his progress, until he gives up his cherished boulder in despair, or retires exhausted and penniless by his useless efforts.

A trial of the flat boats would not, perhaps, be difficult, as they present no startling innovation; but to get the average British Blue-jacket or Tommy Atkins to use a boat like the little folding-coracle would, I admit, be difficult. Were the ordinary sailor or coastguardsman to be given suddenly a curious nondescript bundle of sticks and painted canvas, told to make a boat out of it, and station himself half-a-mile or so outside the mouth of a harbour on a dark or foggy night, on the look-out for a possible torpedo vessel or armed cruiser, if he did not express himself freely, it would be out of respect to his superior officer.

The British coracle, with many other good old institutions, has "gone out," with the few exceptions I have mentioned; and the "hide boat" is no longer a part of the equipment of the British Army, as in the days of Henry V.

The illustrious Major Dugald Dalgetty, when lying wounded and giving his instructions to his allies how to resist an attack by the forces of the great Clan Campbell, was suddenly struck by the incongruous nature of the weapons with which the Children of the Mist were armed. "I forget, ye have no matchlocks or habergeons, only 'bows and arrows.' Ha! ha! bows and arrows." That such weapons should still be in use in the middle of the 17th century struck him as extremely ludicrous. To some, the idea of reviving the coracle of Edward III. at the end of this 19th century may seem equally humorous. But rivers are

the same obstacles to the movement of troops now as they were then; and possibly, in a form more suited to the requirements of modern warfare, the same appliances may be found adapted to overcome this obstacle.

If the folding-coracle and the folding-kyack are useful aids to warfare, the sailor and the soldier *must* be taught how to use them.

The days we hope are passed when, in time of peace, the soldier was looked upon as rather a complicated and costly piece of machinery, to be kept clean and polished (especially about the brass work), drilled and manœuvred, in a soulless, mechanical fashion, exercised like an animated automaton, and dismissed from drill to find his chief ideal of happiness in the brothel and in the pothouse.

We are having an object lesson in the far North-East of the results of a reliance on tradition, competitive examinations, and the consequences, which are the result of an apathy on the part of a people to the condition of their national defences.

We trust that the British sailor and soldier are trained to use the appliances of modern warfare, and to exercise and adapt themselves to the greatly changed conditions under which it is now waged.

Perhaps, among these appliances, the folding-boat may take a modest place, at least, it may be found deserving of a trial.

Lieut-Colonel BAYLIS, Q.C.: I value very much, as I am sure all of us must do, the discussions which are brought about by the lectures to which we listen in this Institution. A lecturer in coming here has a fair field and no favour, and I am sure that is a fact which is appreciated by all of us. I think this is the first lecture which has been delivered in this Institution, with the exception of the Inaugural Address. You, Sir, opened the discussion by adverting to the circumstance of the lecturer being connected with another department, and a most useful department, of the Army, viz., the surgical, and also as having gained the distinction of the Victoria Cross. Many men, outside their profession, have done good service, not only to their own country, but to the world at large, and, I think, we may congratulate ourselves that on the present occasion Surg-Lieut-Colonel Douglas has had the opportunity of giving us this interesting lecture upon rather a novel subject. He has introduced some things to us which we have not, perhaps, seen or known before. I allude to the boat made in the shape of a coracle, which we have seen in Wales, but which is now almost becoming obsolete. That which has very often gone out of use entirely for want of someone like Surg-Lieut-Colonel Douglas to introduce in a new form—that which has gone out of use because it has not been available. I should be glad if the lecturer would inform us what name he would give to his boat. He has described it as a folding-boat, and as being used for river work with a paddle, instead of sculls or oars. I should like to know what he would call it, or what name he would assign to the boat. For my part, I should like to see his own name associated with it, if it is his invention. I do not think the lecturer considers that the use of this boat will dispense with the use of all others, but he brings it forward as an addition to existing boats, and as something that is valuable in itself. What occurred to me as the lecturer was proceeding was this, how very desirable it is to have an available means of communication in the case of emergency. We know how much depends with regard to saving life at sea, and how much may be done by firing a rope from a gun over a mast of a ship and so enabling persons to be brought to shore. It appears to me that possibly this boat might be utilised somewhat in connection with the apparatus. He has also pointed out that anyone with intelligence, that is to say, by mechanical or physical

effort, may go to the other side of the river and establish a communication with the opposite shore; or he may do it by carrying an endless rope to which the boat is attached, which would be found exceedingly useful in forming a means of communication. It might also be useful in enabling one to take soundings of a river to see its depth, and to know whether the river might be forded. We have many fords which are not fords really, but by means of this we might be enabled to ford rivers and to obtain intelligence which would be very valuable to very large numbers of men.

Surg-Lieut-Colonel DOUGLAS: I intended to have alluded to that point, that the boat might be used for the purpose of ascertaining the state of a river with regard to fords.

Lieut-Colonel BAYLIS: I am very glad to find that I am in accord with the lecturer on that point. I think it might also be useful in many other ways. What I understand you intend to do is to convey the communication in the most portable manner. Portability is the foundation of your scheme, that you can easily carry the boat, that you can use it to go down rivers of considerable extent; and, not only that, you can utilise it on your way as a shelter. When you spoke of this boat as coming across the Channel, I should like to ask whether or not you required ballast, and whether you could trust it excepting in very calm weather; whether you think it could be a seaworthy boat for ordinary purposes. It would not go out in a storm, of course, but would it be found sufficiently seaworthy—not top-heavy or likely to be a victim to a heavy sea. I should also be glad to have some further information as to the portability of the boat and the readiness with which it could be folded up when required, and then again made ready for sea.

[The lecturer, in response to Colonel Baylis's request, showed how readily the boat could be manipulated so as to fold it into a form convenient for carriage, and then again to restore it to its original condition.]

Mr. BRUNEL: As having some fresh-water experience on the Thames, I have seen something of these boats—in fact, I have one, having bought one of Dr. Douglas' boats. I must say that I disagree as to there being any difficulty at all in anyone's learning to handle them. Having been in one of these boats, I find that there is no difficulty whatever in anyone learning to paddle and manage the boat. The boats have a very high free board; they are very safe, and they do not tumble over. I have seen a girl get into one, and at once manœuvre it without any difficulty. I am quite sure that a soldier, if he was given the chance of practising with it before he had actually to use it, would be able to manage it readily. It will not do, of course, to keep them all at Southampton, and then put the soldier into the boat for the first time, when he has to do his real work. He should be allowed some opportunity of practice, and then I think he will learn perfectly how to use the boats as well as Dr. Douglas himself. Of course, he cannot kneel in that boat in the same way that the Canadian does in his canoe, but he can get into the boat. I have only been two or three miles in one, but I hope to have more practice this year. I think it is an excellent contrivance, and it is one that can do no harm, because if you are on an expedition in a steam launch or a boat, and you have half-a-dozen of these lying in the bow, and you find them in the way, you can throw them over. If you want to send for help on a dark night, you can send a man away in one of these boats; and in many ways they would be very useful. I think it would be very wise if they were introduced into the Service.

Major-General TULLOCH: I understand that these boats would mean an addition to the transport of an army. Now, from one's personal experience of these things, I must say that against such a boat I should prefer a bluejacket. The bluejacket is always ready for anything you can possibly want. In our various expeditions when anything was wanted, either to cross a river or to get across one of those large Chinese canals, the old-fashioned bluejacket was always ready to rig up something on the shortest notice. I remember when we

were very much pressed on one occasion to get across a broad Chinese canal, there was no boat of any description to be had. Happily, in one of the houses about, we found a large Chinese coffin. In a moment the bluejackets had the lid off, the dead Chinaman fisted out, and the coffin run down to the canal; and that was our boat, and it answered very well indeed.

Lieut-Colonel BAYLIS: I was going on to ask one other question. I was not aware before that reindeer hair had the buoyancy that has been spoken of. I should be glad to know whether that is so—that is, more buoyancy than cork.

Surg-Lieut-Colonel DOUGLAS: The reindeer hair is very much more buoyant than cork. A comparatively small cushion of reindeer hair is now being shown in a tank supporting an iron weight of 14 lbs. without being submerged. There are one or two other points Colonel Baylis was kind enough to ask me about. One was as to the name. I call the boat, if I may be permitted to do so, the "Douglas Folding-boat," and I give the name "Coracle" to the comparatively wider boat, and the name "Kyack" to the comparatively narrow canoe. With regard to ballast, in a small light boat like this, the great point is to keep the centre of gravity low. The man who is on board is the ballast. Perhaps I may relate my experience in crossing the Channel. There was a light northerly wind when I left Dover, a very light wind indeed. I set the sail, and with a single paddle went on ahead swimmingly. When I got about half-way across fog came down, the wind fell altogether, and I took in my sail. I went on with a double-bladed paddle, and I was surprised to find how isolated and lonely the usually-crowded British Channel could be. After going on a few miles, when I got off Cape Grisnez rather a sharp breeze came down from the west, which increased until it got up a very nice ripple on the sea. My boat was decked over; I had cork belts on each side, and though I shipped a little water I paddled on, taking precautions to meet the sea in the right way. I got to Calais perhaps rather later than I should have done if the weather had remained fine, but unscathed, though very cold and very stiff. I am exceedingly obliged to you for your kind reception of my paper.

Mr. E. C. F. JAMES: With regard to reindeer hair, I might perhaps mention that it has been ascertained that 2½ lbs. of reindeer hair will support 20 lbs. weight.

The CHAIRMAN: Gentlemen, in summing up the discussion I should like to refer to what General Tulloch said, viz., that he preferred a sailor to a boat. That would, of course, depend on what you might have to cross. For instance, Dr. Douglas told us how he had crossed the Channel in one of these boats. I am afraid a sailor would find some difficulty in improvising a means of transporting anyone across the Channel. Similarly, it is found that pontoons and other means of crossing rivers are an absolute necessity to military men. I hardly see how we can dispense with something of the kind. It may become a comparative question of lightness or facility or advantage when we have the means of transport, but I think, at all events in European warfare, armies have always found it necessary to take with them some appliances for crossing rivers, seeing that they are always liable to have bridges broken against them if they do not. As far as I can see, one great advantage of such boats as have been referred to would be that, by crossing the river easily, you may have the command of the other side, and then you can lay down your pontoons and make your connection, as we always do to-day wherever we have to make a military passage over a river. Once getting a number of men on the other side, we can establish the connection; the thing is to get to the other side first. Of course, one cannot attempt to go into the merits of the different types of boats, but I am a little sorry that Dr. Douglas was prevented from giving us a fair description of the distinction between his collapsible boat and the Berthon. I understand we are to have a lecture next Wednesday on the Berthon boat, and then we shall have a fair opportunity for comparing the two together. Whatever may be the comparative merits of the two systems, that some

kind of collapsible boat would be of great advantage to us for many purposes is tolerably certain. I have now to convey your thanks to Dr. Douglas for the lecture he has given us. It is on a subject to which, as I have said, he has given a good deal of attention, and his claim to acquaintance with a branch of the Service somewhat outside of his own particular profession has been thoroughly well justified, by the lecture he has given us.

Major-General TULLOCH: May I be permitted, with reference to what the Chairman has just said, viz., "a sailor would find some difficulty in improvising a means of transporting anyone across the Channel," to recall the fact that in 1805 an English sailor who had escaped from a French prison was captured on the beach at Boulogne, as he was about to attempt to cross the Channel on a tiny raft he had constructed. The sailor was brought before Napoleon, who so much admired his daring and ingenuity that he gave him his liberty.

Wednesday, March 20th, 1895.

Lieut-General J. KEITH FRASER, C.M.G., Inspector-General of Cavalry, in the Chair.

The CHAIRMAN: Ladies and gentlemen,—Mr. Berthon, Vicar of Romsey, was well known to the old Royal United Service Institution. It is more than forty years since he gave his first lecture there, and he lectured there again some seventeen or eighteen years ago, on ships' boats, for the object of saving life in case of shipwreck. I, therefore, do not think it is necessary to introduce him here, because he has lectured before this Institution before many of you, perhaps, were born. In addition to being well known on account of his duties as Vicar, I may tell you he has established a factory where employment is given to a large number of lads, and he has done an infinite amount of good. If he lectures as well as he preaches I am sure his lecture will be a most interesting one.

COLLAPSIBLE BOATS AND PONTOONS FOR MILITARY PURPOSES.

By the Rev. E. L. BERTHON.

IT is hardly a task for a civilian to attempt to point out to military men any deficiency in their appliances for the more perfect conduct of the operations of war; but there is one circumstance upon which all observers must be agreed, viz., the obstacles presented to troops of all arms by flowing streams; and though this subject has not been lost sight of, it has never before assumed the importance that it manifests at the present moment, when the fate of a campaign may depend upon a few hours gained or lost in overcoming the natural obstacles presented by rivers. So many instances of this evident fact will occur to the minds of all who are acquainted with the annals of war, that it is needless to refer to them.

My object is not to demonstrate the frequent existence of the above-mentioned obstacles, but how to overcome them in a manner that is at once practicable and effective. I think, therefore, that I shall be pardoned if, in this paper, instead of enlarging upon any of those considerations which properly belong to soldiers, I confine myself to what has been accomplished, and may be further extended by means of a system which it has pleased God to place in the hands of a civilian and a clergyman.

All readers of ancient history will remember how the armies of Xerxes and Alexander the Great crossed rivers, and I believe also the Hellespont, on rafts constructed of light frameworks of wood covered with skins; and when the Romans first visited these islands they found the natives using such frail flotations for the purpose of fishing, and to these tiny boats they gave the name of *coriacula*, because they were made of *leather* stretched over a frame of wickerwork; hence the name of *coracle* has ever since been applied to such structures, and, with very little alteration, they are still in use on the West Coast of Ireland and elsewhere. It was not, however, any of these coracles that

led to the idea of the boats and pontoons described in this paper, for they did not admit of being reduced in bulk for the purpose of transport; nor did the thought of crossing rivers by such means occur, in the first instance, to the mind of the inventor. No, it was for saving life at sea that the principle of *collapsibility* first presented itself. It was immediately after the terrible wreck of the S.S. "Orion" on June 30, 1849, off Port Patrick, in perfectly smooth water, when more than a hundred first-class passengers were drowned for want of boats, that it fell like an inspiration upon the mind of the inventor that good and convenient *lifeboats* could be so constructed as to fold up and be stowed away in a very small space. It came in some such form as this :—

Instead of transverse ribs in a boat, make them longitudinal, and link them together at both ends, and in place of rigid planks put on segmental pieces of a strong waterproof material, so that the ribs may be made to fall down side by side with the flexible material folded between them. Moreover, it occurred almost immediately that if the ribs were made broad and flat, like thin slices of melon, a second skin might be attached to their inner edges, and the air inhaled into the cavities so formed, in the act of expansion or opening, would cause the boat to become an *insubmergible lifeboat*.

It would be a painful task now to relate the history of this invention in its early stages, and the opposition it met with both in the Royal Navy and the Mercantile Marine, although the most convincing proofs were given that boats built on this principle could compete in safety, speed, and all sea-going qualities with those of wood, and at the same time be stowed in about one-fifth of the space; suffice it to say that such boats were built, and one of them, 30 × 10 feet, which carried 100 men, had the honour, forty-two years ago, of having the Queen and the Prince Consort on board. Nevertheless, the opposition was so strong that I was compelled to abandon the invention, and it lay buried twenty years.

In the Spring of the year 1873, I received a letter from Mr. Samuel Plimsoll, in which he told me that he remembered my work twenty years before; and though the world was against me then, it would be ready to adopt my system now, adding that it was my duty to begin again.

Accordingly I lost no time. I hired about twelve men, built a shed a hundred feet long in my vicarage meadows, and set to work. Soon after Admiral Sir William Mends, the Director of Transports, came down to Romsey, witnessed experiments with my boats, and procured me orders for £15,000 worth for H.M. troopships, and since that all the transports carry these boats. The great success of the invention for sea-going purposes—the enormous strength and durability of the boats exceeding all expectation—led me to adapt the same principle to military purposes; but a new departure became necessary, viz., that of building the boats in *sections*. The bipartite principle was recommended by my friend, Admiral Ryder. He wanted the principle to be adopted for the torpedo boats, 12 feet or 14 feet long. The idea immediately struck me of dividing the boats into two, and then they could go below deck. It was first applied to dinghies for the torpedo-boats, which, constructed in

two pieces, were easily carried beneath the deck; about 150 were built for our own Admiralty, and 650 for the French, besides those for many foreign navies. Here was a principle that seemed to offer immense advantages for pontoon bridges, and was favourably mentioned by General Sir Howard Douglas in his excellent work on this subject; but it was ignominiously condemned and rejected by the prejudice of another General R.E., who refused even to look at a bridge I had thrown across the Thames at Runymede, because canvas was used in its construction. Not so the officers of the Prussian Army, and after several years of exhaustive experiments that army has been equipped with 230 tripartite 22-foot pontoons, all made by me as Constructing Director of the Berthon Boat Company.

More than three years ago we invited the chiefs of the Royal Engineers' Committee to see a bridge thrown over the River Test, at Romsey, formed with some of the pontoons built for Germany; the trials were perfectly successful, and a wagon, weighing five tons, was drawn across by four horses. And there the matter ended, as far as our own country is concerned, but not so in the mind of the inventor. I saw that, though the *tripartite* pontoons are considered perfect in Germany, great improvements could be made when wanted for our own Service, one of which was the substitution of *bipartite* boats for those made in three sections. Another new departure was to construct light pontoon-boats to be carried on two-wheeled carts, to accompany cavalry and horse artillery.

A third addition was that of making efficient boats so convenient and light that they could be carried on horses at any pace and over any country. I propose, therefore, to confine what I have to say to the exposition of these three developments:—

1st.—Pontoon bridges.
2nd.—Light pontoon boats on carts.
3rd.—Boats carried by horses.

1st.—A pontoon wagon on this principle carries two 24-foot pontoons in two sections, each section being 12 feet long and 5 feet wide; twelve baulks 10 feet long, twenty-four 10-foot chesses, four saddles, eight bearers, and the usual outfit of anchors, cables, oars, etc., etc., the whole well within the limits of the regulation weight. Thus:—

	lbs.
2 24-foot pontoons (four halves)	900
12 10-foot baulks	378
24 10-foot chesses	1008
4 11-foot saddles	100
4 7-foot bearers	32
8 4·5-foot stanchions	32
Anchors, cables, oars, etc.	300
	2,750 lbs.

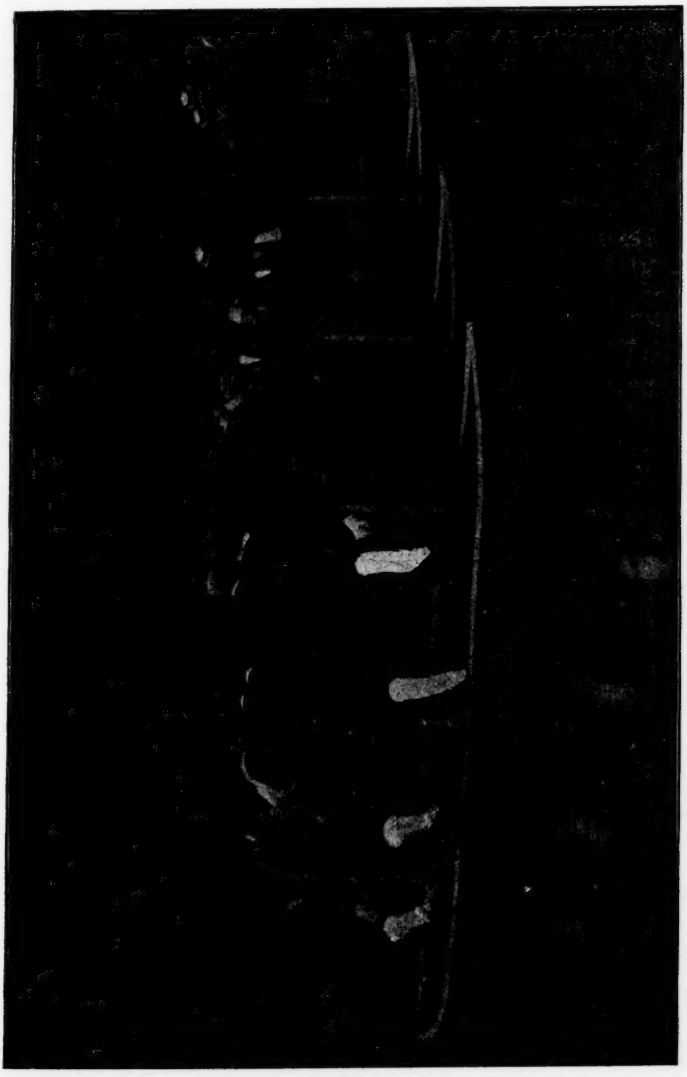
or, 1 ton 4 cwt. 2 qrs. 6 lbs.

As the time required to open and set up these pontoons in halves is only a few seconds, and they can be thrown into the water and connected afloat, it will be found that they are more convenient to handle than those in the Service. Two men can run with a half-pontoon, and carry it in halves over ground too rough to drag one of wood.

The same advantage of lightness will be found in dismantling the bridge, taking the pontoons out of the water, and re-loading them on the wagon. With regard to the anchors, it may be said that, if I double the quantity of pontoons, I must double the quantity of anchors. You will, perhaps, want more cables. The resistance, as far as the stream is concerned, will be exactly the same, whether you have it on a larger number of light pontoons, or a small number of heavy ones—the displacement will be exactly the same. In fact, it will be rather less, because my pontoons weigh less than half the others. As far as the anchoring goes, therefore, we need not consider that, though perhaps we may want more cables. When I was in Berlin about two years ago, I saw a bridge thrown across the Spree. The Germans used my pontoons the same way as they use their own. They had no anchors at all; nor did they put a rope across the river (which is one way), but they used kedges, which are very convenient indeed, and do not weigh much more than one-fourth of what the anchors weigh. I do not want to find fault with our friends the Royal Engineers, but I think some of their materials might be employed a little more economically. To make baulks from one end to the other all the same thickness is a great waste of material, and adds to the weight. My baulks are made of strong American elm, and securely fixed round the curved side. It is 6 inches in depth, instead of 7 inches. The difference of the square of 6 and 7 is considerable: one is 36 and the other 49. My baulk only weighs $31\frac{1}{2}$ lbs., but the Service baulk weighs 84 lbs. Mine will carry nearly $2\frac{1}{2}$ tons, whereas the other will carry only 1 ton 16 cwt. That is the breaking strain. I have tried it by direct test, and calculated it. There is an undoubted saving, and I commend it to the consideration of the Royal Engineers. I hope they will not consider me impertinent. This form also enables me to considerably reduce the bulk of my pontoons.

I believe, also, something may be saved in the weight of the wagon. Perhaps it will appear, at first sight, that the weight of twelve baulks (450 lbs.) has been put too low; but a little consideration will show that it is correct. The central intervals between the pontoons now in use are 15 feet, and each baulk weighs 84 lbs.; as my central intervals are only 10 feet, the scantling, or sectional area, of my baulks to bear the same weight will be only two-thirds of that of the 15-foot ones, and their length also two-thirds; so the weight of the former is $\frac{2}{3} \times \frac{2}{3}$, or $\frac{4}{9}$ of 84 lbs. But this is not all; I make my baulks *fish-bellied*, and further strengthen them by adding a skin of American elm, applied bent, and well secured to the curved under-side. It should be observed also that my system of superstructure requires no ribands, and these in the Service pontoon weigh 85 lbs. each, which I save.

As to flotation, or the displacement of the boats afloat: First, as my intervals are 10 feet against 15 feet, I have 50 per cent. more in this way only; but, as my pontoons are 3 feet, or one-seventh longer, I have



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11·9 per cent. in addition; so that the displacement, or sustaining power, of my bridges is 61·9 per cent. greater than that of those now in use. The 6-horse-power steam sapper can safely cross this bridge. Now, I

submit that the advantages of my system are many and various. First, each wagon carries a complete unit of bridge, consisting of *two* pontoons and *two* bays of superstructure complete; by using the whole of each (halves united) of the twelve baulks and twenty chesses, we have 20 feet of roadway, 10 feet wide, for traffic of five or six tons. But, by using the half-pontoons *separately* at 10-feet intervals, and disposing the chesses *longitudinally*, we have 40 feet of bridge, 6 feet wide, for guns and carriages up to nearly three tons. Again, each wagon comprises a raft, with platform 10 feet wide, or *two* of 6 feet; or two separate rafts with platforms 6 feet wide.

Connected with the subject of bridge-making on this principle, there is an important consideration in making *cuts* in a bridge. I find that, owing to the particular arrangement of the baulks in the Royal Engineer Service bridge, it is necessary to provide *cut rafts* with specially constructed baulks for this purpose, and even then the process of making and restoring a cut is rather complicated.

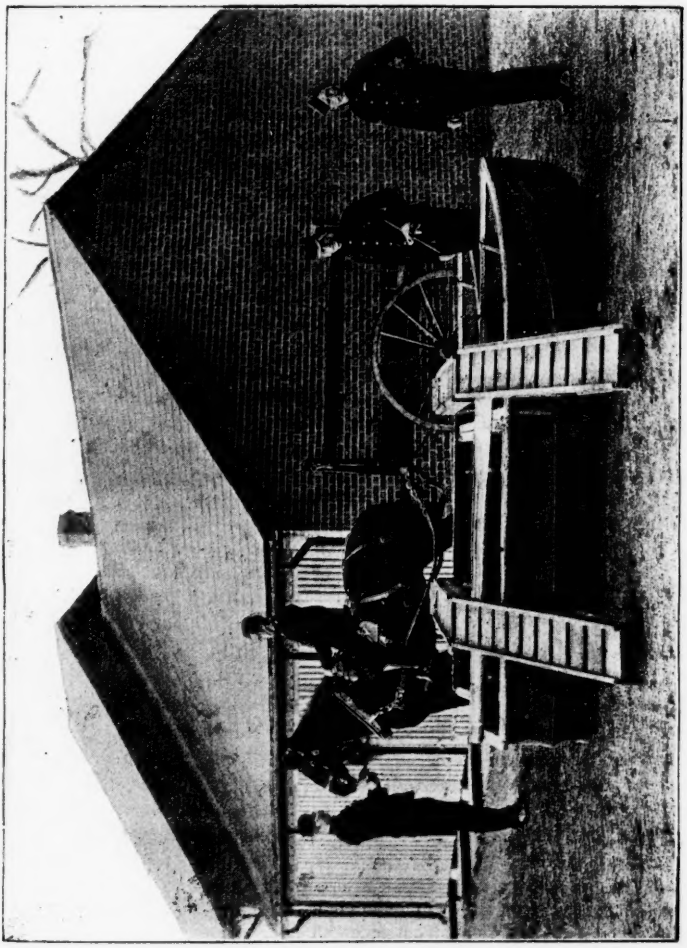
In my system all this provision is unnecessary, and the operation can be performed with the greatest ease and expedition. Of course, every inventor sees merits in his own project; but I would simply ask if all these advantages have been combined in any other system. I would only observe that, having had long experience in building at least £200,000 worth of boats and pontoons of all shapes and sizes of canvas, I can confidently assert that this material, when coated and saturated with our flexible waterproof paint, is stronger for floating bodies, as well as more durable than wood. And here it is well to observe that all my boats and pontoons have inherent or *intrinsic buoyancy;* they are, in fact, insubmergible lifeboats, owing to the large quantity of air inhaled into the air cells in the act of opening. This also provides an additional safety in case of accident, because, should the outer skin of canvas be cut or torn, the water enters into the wounded compartment only, and scarcely affects the flotation.

Perhaps it will be said that there is nothing gained by increasing the flotation or sustaining power of a pontoon bridge beyond that of the Service form, but I would submit that the displacement of the pontoons now in our Service at 15-foot intervals—the boats themselves being of the small length of 21 feet—is not enough, in the opinion of foreign officers, to bear the weight of infantry when very closely packed by a "check." Nor would they, at that distance—15 feet—sustain the weight of a steam sapper, which my 24-foot boats at 10-foot intervals will bear.

Time and space forbid my entering upon a minute description of the details of these bridges; the model will give some idea. But the real full-sized bridges which we have at our works at Romsey can be thrown across the river there at any time.

The second application of this principle to military purposes is that for swimming horses and ferrying guns and wagons over rivers. This, I have already observed, has been introduced into the armies of Prussia. During the last three years they have been using my tripartite boats for these purposes with perfect success, and the perfection they have reached,

not only on the part of the men, but, what is more, of the horses, is really surprising. I was told by an officer of the Imperial Pioneer Guard that he had seen a division of cavalry, 1,800 strong, cross a river in less than three hours by means of six of these pontoon-boats. The operation was performed in this way:—Eight troopers, in two lines, rode into the river



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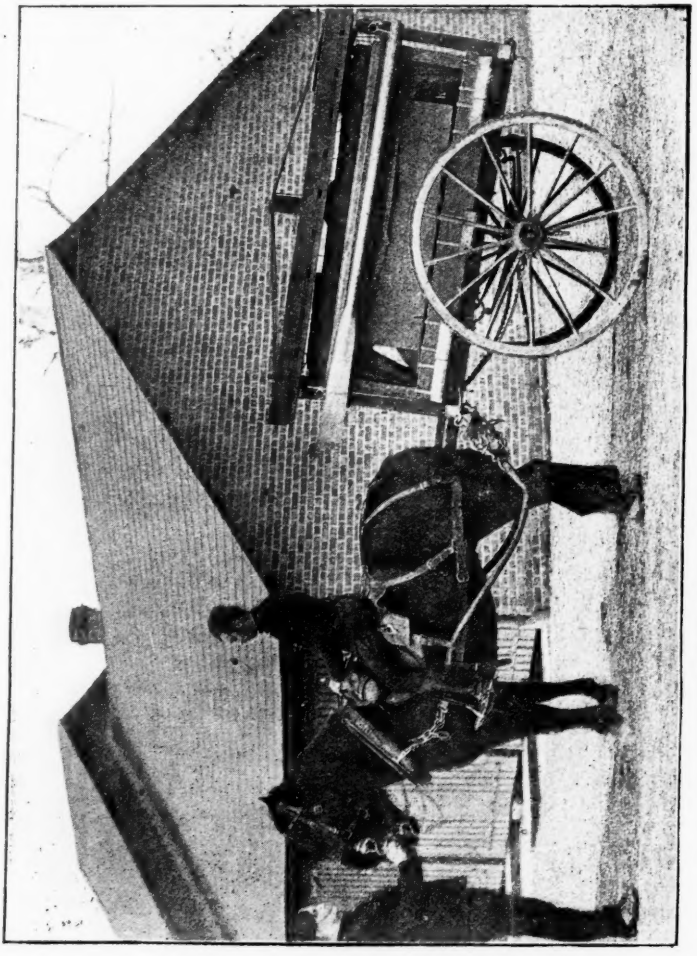
(the bottom of which was shelving gradually to the bank), four on each side of one of the boats; they all dismounted on board, with their saddles, arms, etc. Two men at the stern then shoved the boat into the stream; the horses walked till they could no longer touch the bottom, and then, by swimming, they crossed the river, and the pontoon (now

become literally an 8-horse-power boat) travelled, without rowing, at a very good speed. Arrived at the other side, the men re-saddled, mounted again, and rode up the bank. The boat was then rowed back for another trip. Of course, it will be understood that all these horses had been practised in this manœuvre, and, possibly, German horses are more



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tractable than ours; but, I feel convinced that a very little practice would be enough to induce English horses to take to the water as readily as those of Germany; and I submit that this exercise should be included in the training of horses for our cavalry and horse artillery.

In the Prussian Service these pontoon-boats are carried on wagons,

but such carriages are evidently unfit to follow the rapid evolutions of cavalry and horse artillery. I have, therefore, made a new arrangement for this special purpose, and it has been tried with great success at various places. I cannot say what was done at Aldershot with the light cart and boats, but I know the trials under Colonel Lord Erroll at Windsor were considered perfectly satisfactory; and I am happy to say that General Keith Fraser was kind enough to express his entire approbation of what was done under his command at Churn. This modification consists of a 24-foot boat in four sections each of 6 feet long. These are carried on a light spring-cart, side by side. When all are opened and united—the work of two or three minutes—a boat is formed 24′ × 5′ × 2′·6 for swimming horses. For ferrying guns, etc., a raft is made by dividing the boat in two 12-foot lengths, and skids 8 feet long are made to rest on saddles on each half-boat; two other such skids connect the raft with the shore, over which the gun and limber are wheeled on board; the shore-ends are then embarked, and the raft rowed across by men in the bows, and steered by others in the sterns; this raft will carry any weight up to three tons. It may be used very conveniently as a "pont volant" or flying bridge, and it has buoyancy for forty men or more.

The weights are as follow :—

	lbs.
Boat in four parts	500
Four skids	200
Two saddles	40
Over scotches, etc.	36
Cart	560
	1,336 lbs.

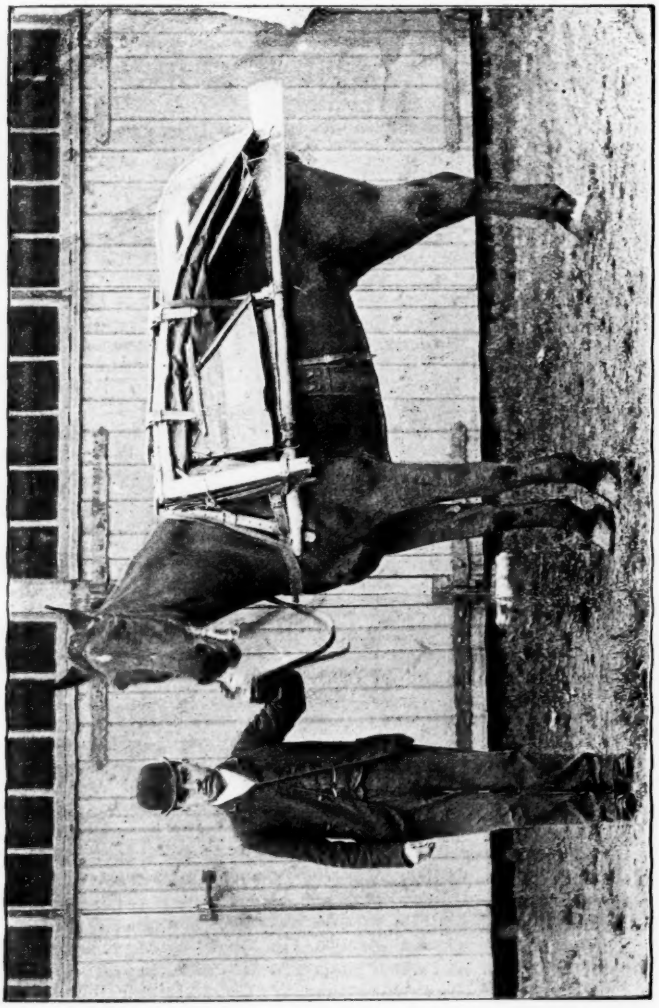
Total cart and load under 12 cwt.

With two horses this cart can accompany horse artillery anywhere, at any speed, and, should one horse be disabled, it would be an easy load for the other.

With respect to the last of the three developments of my system now produced for military purposes, I have observed that very intelligent remarks have been made lately about the possibility of carrying light boats on horses that could gallop across country and clear any object that cavalry could negotiate. Of course, the ordinary pack-horse or mule could not do this; but I think it can be accomplished in the way tried by General Keith Fraser at Churn.

Our engraving shows a very pretty, well-shaped boat carried on an extremely light saddle by a horse. This boat is 10 feet long, in two halves, 3 feet 6 inches wide, and, when collapsed, its width or thickness is about 7 inches; the weight is less than 80 lbs., but it carries four men well. The half-boats can be opened, united, and launched in one minute, and it rows very well. The weight of the saddle is 20 lbs., and it is made with four adjustable pads to fit the back of any horse. As the total weight, including the saddle, does not exceed 100 lbs., I believe a horse could keep up with cavalry in the most difficult country. The

saddle now exhibited must not be considered as fiducial. It is, in fact, only experimental; and should it not be found perfectly satisfactory, it must be possible to produce a saddle that shall be quite comfortable to a horse carrying a load less than that of a child seven years old. I know



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that General Bogle has invented a peculiar saddle, with which a horse is able, with a mountain gun, to clear a bar 4 feet high; but the nature of the load is so different that it would require a perfectly different contrivance to carry collapsible boats.

The large 22-foot tripartite pontoon now exhibited is exactly the same as those in the Prussian Army. I consider this objectionable, because it does not lend itself well to equal division for the long light bridge.

But the bow-pieces are exactly the same in size, form, and weight as those of the quadripartite boat on the cart. I know that some people unaquainted with my boats think they must be too weak to withstand collisions, but this is quite a mistake, for their peculiar construction, securing great *elasticity*, renders them far less amenable to injury than other boats.

I should like to mention this one thing. Our gear, whatever it is, guns, carriages, and everything else, have not only to do with European concerns, but very greatly with India and Africa, where rats, white ants, and other things abound. For the last twenty years we have had boats in the centre of Africa, and also in India; but the white ants and rats do not touch them. There has not been a case of rats having hurt these at all. If any officers of the Royal Engineers are here, I should be extremely pleased if they would allow me to mention the subject of materials, because the materials we use I think are superior, and at the same time very much cheaper than those used in the Service. Each of my bays, from centre to centre of the boat, is 10 feet, and the width is 10 feet, so that each one is exactly a square. This admits of the chesses being placed either way. Probably some of those gentlement present who are particularly interested in bridge work, will kindly look at the model I am now showing, in order to see the improvements, or what I should think to be improvements, viz., the dispensing with ribands, racking, and that sort of thing, and the manner in which my baulks are put together.

The CHAIRMAN: Ladies and gentlemen,—I am sure we have all listened with the greatest interest to the remarkable lecture which has just been delivered so well and clearly by Mr. Berthon, as to make us all, even unscientific people, understand what he means, and the way in which he has carried his objects out. I hope we shall have a good discussion upon the subject, and that many who are here will speak both with regard to the scientific part which they understand better than I do, and also as to the use of the bridges and pontoons in connection with the movement of troops, and especially with regard to the movements of cavalry, because that is what appears to me to be of the greatest possible importance. You may have large pontoons for carrying an army across, but cavalry want something very light, so that it can be carried in light carts. I hope, therefore, that all those who are interested in this subject will give us their opinions.

Colonel LONSDALE HALE: I rise to open the discussion, because the suggestion to the Council that we should do ourselves the honour of asking Mr. Berthon to favour us with a lecture emanated from myself. In the old days, when we had the old Engineer pontoon trains, I was subaltern for two years, and therefore I understand something about the technicalities of the subject. Of late years, however, I have rather gone away from the technicalities of engineering, and my attention has been directed mainly to military operations both on large and small scales, and nothing has impressed itself more upon my mind with regard to military observation than the supreme importance that every army should be provided with a thoroughly effective and efficient bridging equipment, not only for large units but for very small units. Those who, like myself, have studied the movements of troops and the work off the battlefield, know that any bridge equip-

ment, to be effective, should possess mobility, portability, and, I may say, compressibility. I say mobility, in order that the bridging train may move as rapidly as possible from one point to another. I am not going to take up your time with illustrations of military history, but cases may occur where the bridging train is thirty or forty miles away from the point where the crossing is to be, and therefore there is a necessity that it should be extremely mobile; it should be portable, that it may be easily carried down from the wagons to the river bank. With regard to compressibility, by that I mean to say that the boats should be put into as small a space as possible, so that they should not be confined to the main roads, but should be able to go amongst tortuous by-ways, and even possibly across a country track. About a year ago I was asked by Mr. Berthon to go down and see his equipment. We had rather a gallery day on that occasion; but I went down subsequently with Major Dickinson, and I had the advantage of making a thorough examination of Mr. Berthon's equipment. Afterwards I went down to my own corps at Aldershot, and saw the present bridging equipment. The idea came to my mind that the time had arrived when we might have a lecture and a discussion, and a thorough comparison between the two systems, and that is the reason why this lecture has been initiated. I thought that this place was better than Chatham, because here we could get officers of the different parts of the Service. This is not an engineer's question alone—for the efficiency of one branch of the Service affects the efficiency of other branches. We have representatives of many branches here, and I hope they will tell us what they think of this bridging equipment. But as this is primarily an engineering question, I wrote to General Grant, the Inspector-General of Engineers, and asked him if he would come here, but unfortunately he is not able to do so; but he has written to Aldershot and Chatham, and we have here this afternoon experts from the Royal Engineers, and I can assure Mr. Berthon (who has been rather severe upon the engineers in his lecture) that we have quite given up the old idea, that nothing can possibly come from anywhere but Chatham. I think we have got rid of that idea, but the engineers who are here as experts will be at liberty to point out the defects they consider in Mr. Berthon's invention. They are coming with open and unprejudiced minds with regard to it, and I hope that infantry, cavalry, and artillery officers—I am pretty sure about the cavalry—will speak their minds and will not say that this is a matter for the engineers, and they have nothing to do with it and do not understand it. It does affect them most materially. If we engineers cannot provide an equipment good enough for the artillery, cavalry, and infantry, it is their business to tell us so. With regard to the cavalry, I know our Chairman has strong views on that subject, and I think no other equipment can possibly be complete which does not provide especially for the cavalry; you must have something special which shall be used for the cavalry. I do not mind speaking about cavalry, and my study of war leads me to a different conclusion upon this matter from that which the General holds. The General is quite content that the bridging equipment for cavalry shall be a cart able to carry cavalry and artillery. I am, however, quite certain that the cavalry ought to be provided with something also not on wheels, and which will enable even an officer of patrol to go across a river. Whatever equipment we give to cavalry, we should give something which can be carried, as we see in Mr. Berthon's system, on the back of a horse. I was present at the cavalry manœuvres in Berkshire this year. We got to the top of a hill not a hundred yards from the bank of the river, and as it would have been unsafe to take the cart down the hill, it had, therefore, to stop at the top. If it had been upon a packhorse, everything would have been brought down with the greatest possible ease. The only point in which I differ from the General is as to the extent to which the cavalry equipment should go. By all means have a cart, but I know the extreme difficulty of getting wheels over the country. It is all very well when you have an ordinary road, but the occasion may arise when

you cannot use your wheels. You, therefore, ought to have an equipment which can, when necessary, be taken on a packhorse. I will not detain you longer than to express the regret I feel that we have not here this afternoon the device for crossing rivers which Mr. Berthon saw, and which was shown at the Berkshire manœuvres by Captain Rimington, of the Inniskillen Dragoons, who, I am glad to say, is present. If the General will not have his pack-saddle, at all events we can fall back upon our ordinary corn sacks. The system is eight corn sacks, a little bit strengthened and waterproof, and filled with hay or anything else. They are then tied together, and if you have a lancer regiment you can use the lances and so make a super-structure of that kind. These sacks, filled with hay, carried five adults safely. I hope that we shall very soon have in the Museum an example of Captain Rimington's system.

Major DICKINSON: I have listened with great interest to Mr. Berthon's admirable lecture. I have to thank him not only for the pleasure I have had to-day, but for his courtesy and kindness to me at Romsey on the occasion which Colonel Lonsdale Hale has referred to. I make these remarks with some diffidence, because I quite recognise the fact, not only that there are many officers here who are more capable to speak on the subject than I, but that Mr. Berthon has considered and devoted his skill and time to this very subject for more years than I, perhaps, number in my whole life. I can only trust that the remarks I may make will have the effect of eliciting the opinions of the lecturer and of others which are more valuable than my own. The lecturer has divided his subject into three heads. First, pontoon bridges. By pontoons, I imagine that he means to refer to the pontoon train of an army corps. Perhaps I may be allowed to make a few remarks on this head, as it is the head with which I have more practical acquaintance than any other. What I have to say will relate principally to that point. We use, as Mr. Berthon knows, in the Service 15-foot intervals from the centre of one pontoon to the centre of the other, whereas the lecturer advocates the use of 10-foot intervals from the centre of one pontoon to the centre of the other. He claims for that short interval three advantages, namely, that his baulks are lighter from the fact that they are shorter, that material for one raft can be carried on one wagon, and that the sustaining power of the pontoon is greater in proportion to a fixed length of bridge. Something, however, I think, can be said on the other side. By shortening the intervals we get a waterway, in the system advocated by Mr. Berthon, which is no greater than the width of his pontoon. The width of his pontoon is 5 feet, and the width of the waterway between the pontoons 5 feet. He has referred to the fact that the strain on the cables is proportional to the displacement. That I have no doubt is the case as regards current, but I think he forgets the fact that when there is a strong wind blowing the effect on the cables is very much increased, and, undoubtedly, with his pontoons, at the closer interval he puts them, he will suffer in that way. Certainly, the holding power of his anchors and the number of his cables must not be less than ours are at present.[1] I think they would have to be more. This one disadvantage, I think, is inherent to placing the pontoons closer together. Another point, which I think very important, is that, undoubtedly, our 15-foot baulk is a very useful article. Spans frequently have to be bridged of less than 15 feet in width. That can be done with a single bay in a few minutes. The gaps that have to be bridged of less than 10 feet are of much rarer occurrence. Further, the 15-foot baulk is extremely useful in spar bridging, trestle bridging, suspension bridging, and all sorts of bridging, other than pontoons. The 10-foot, fish-bellied baulk, which the lecturer has shown us, would be certainly very much less useful. To sacrifice our 15-foot baulk would, I think, be sacrificing a great deal. With regard to flotation,

[1] The Prussian six-fluke grapnels hold quite as well as heavy anchors, with less than a quarter of the weight, besides stowing in a very small space.—E. L. B.

the lecturer says that, by placing the pontoons closer together, the relative displacement for a given length of bridge is increased. No doubt that is the case; but if you have sufficient flotation in pontoons at 15-foot intervals, is there any object in placing them closer together? For these reasons I have not been convinced that the balance of advantages lies with the shorter interval between the pontoons. I have no doubt it is known to most officers here that our present service bipartite pontoon enables us to make a bridge of the ordinary width of roadway, 10 feet, or it enables us to make a double length of bridge with a narrow roadway. I think we should gather, from what the lecturer says on the subject, that his equipment only has that advantage. We can with our present equipment, if we are prepared to sacrifice a portion of the width of the bridge, double the length of the bridge. We further have, with our equipment, some small advantages which I do not think can be claimed by Mr. Berthon. We can make a boat of any length. Our bipartite pontoon consists of two portions, one of which has a bow end to it, and the other has not, but has two square ends. By means of inserting the necessary number of square ends we can make a boat of any length we like, and make a bridge 10, 20, and 30 feet wide, or any multiple of ten. Further, we can make long rafts by inserting the necessary number of square ends. By using one square end to every bow end we can make transport rafts of four sections, which is a very great advantage where you have to move pontoons along a waterway.[1] I do not know that with a roadway wider than 10 feet one would be likely to use them for bridging, but they come in very useful in the case of pierheads and things of that sort. The lecturer has spoken of the process of making cuts in service pontoons, and of its being a very complicated affair. If I could show it to him I could convince him that that is not the case. I think we have gathered from what he said that the cut raft was a special raft. That is not the case at all; the cut raft is precisely the same as any other raft in the bridge. The only speciality connected with the cut raft is its connection with the standing part of the bridge. That connection is simple. We can make cuts without it, but we use it for the sake of rapidity and simplicity. We must remember that on service the ordinary bridge train is liable to very rough usage indeed. The number of sappers in a pontoon troop, on a war establishment, is small. The pontoons will constantly have to be handled by men who are not very much accustomed to their use. They will have to be hauled up on rocky, stony beaches, and at a time when it will be very difficult to get at them to repair them. I think it must be admitted that our Service pontoon will take a great deal of scratching and knocking about before you make a hole in it. The question is: Will canvas pontoons stand as rough usage as ours will? I cannot think that they will.[2] The outer skin is no doubt a protection against the sinking of the boat, but if the outer skin be perforated it will let water in between the outer and inner skin, and if it is the case, as the lecturer pointed out to us, that it will not entirely fill the space between the two, a very large portion will be filled, and the compartment filled will run from one end of the boat to the other. Will not then the boat become waterlogged? [Mr. BERTHON: No.] On the other side the lecturer has claimed advantages as regards weight. I think it amounts to this. I am considering now the bridge for carrying the ordinary loads such as it would be necessary to carry on service. Every 20 feet of bridge of collapsible boats, the lecturer has told us, weighs 1 ton 4 cwt. 2 qrs. 6 lbs. Every 15 feet of Service

[1] If the pontoons on the wagons are made like those on the light cart, viz., with two bow sections, and two with both ends square, a boat *on one wagon* can be made either 12, 24, 36, or 48 feet long. Whereas on the R.E. system it takes *two* wagons to make a boat 42 feet long.—E. L. B.

[2] The canvas pontoons have *keels* and rubbing pieces on their bilges. They are never injured by dragging over shingly beaches; besides being so light, when a pontoon is divided in two it is easily carried by two men.—E. L. B.

bridge weighs 1 ton 1 qr. 6 lbs., that is to say, practically 15 feet of our bridge weighs as much as 20 feet of the collapsible bridge. In connection with that I should like to mention the fact that the item which the lecturer describes as anchors, cables, etc., in our case weighs 382 lbs., whereas he has only allowed 300 lbs., that is to say, he has omitted something which we consider necessary—whether it be weight of anchors or not, I do not know. I should like to ask Mr. Berthon if his boat would take the ground well if grounded. The Service pontoon will take the ground very well, provided it be not very rough. No one would think of grounding a pontoon if the ground was not fairly smooth, such as the ground in a tidal river. I believe that our pontoon acts very well when it has to be grounded under ordinary circumstances. So much for the first division of Mr. Berthon's subject. With regard to his second division, pontoon boats on carts for the cavalry division acting independently, I am sorry to say that I am not in a position to give any definite opinion. I have seen them, by Mr. Berthon's kindness, at his own works, but I have never seen them actually at work, and I have never had the handling of them myself, although I should very much like to do so. For that reason I am not in a position to express any opinion upon them at all. I can realise the fact that the problem of finding the best equipment for cavalry purposes and for the purposes of a pontoon train of an army corps is rather a different one, because the importance of mobility as compared with durability is very much greater. With regard to the swimming of horses, of course, any boat will do for that. With the Service pontoon we have walked our horses into the water, and swum across in the same way as Mr. Berthon has described. I should like to ask if it is not a fact that these truss-beams which I see on the light equipment which has been exhibited do not interfere with the rocking of the boat, so that if there was rough water, would not that increase the danger of the water coming into the boat?

ADMIRAL SAUMAREZ: I think I was the first naval officer, when First Lieutenant of the "Sampson" in 1852, who had trials of one of Mr. Berthon's collapsible boats, and I was enabled to hoist it between the ship's side and our cutters at the davits with oars and sail. I tried the boat in a good breeze, and drove her on purpose on a rock to test her. I need hardly tell you that it caused great rents, but it did not disable the boat in any way. The boat was perfectly safe, and after we had patched her up again she was just as ready for work as before. The lifeboats we have now in the Channel Islands are those of Mr. Berthon's. I am sorry they are not more generally in use than they are. I know no better contrivance than Mr. Berthon's collapsible boats for saving life at sea.

The CHAIRMAN: Is there any cavalry officer here who will give us his opinion on this subject? I am afraid General Wilkinson is not here now; if he had been I should have asked him to say a few words about the necessities for cavalry crossing rivers. Mr. Berthon was kind enough to lend one of his boats to the Royal Horse Guards, at Windsor. One of the officers who carried out the experiments of crossing the Thames is here, and I am sure we should be very glad if he would be kind enough to tell us how it was done, and what they thought of Mr. Berthon's boat.

Captain FERGUSSON, R.H.G.: All I can say on the subject is that none of us—except, perhaps, Lord Crichton—knew anything at all about the boat, which was sent down to us by Mr. Berthon. A squadron was told off to use it, and in a few days, after a little practice, they could get the boat into the water in about a minute. The first boat we had was only a two-jointed one, with two pointed ends. The horses, of course, at first knew nothing about it, and at starting it was a matter of a good deal of pulling. After a time, however, it answered very well. On one occasion I remember a horse being very bad, and when it got about half way up to its withers in the water it began to plunge a great deal, and in doing so put one of its feet not only through the outside skin, but scratched a hole in the

inside skin. All that was done was that someone put a handkerchief over the hole in the inside skin, and the boat went on all right with another thirty or forty horses. Our feet were a trifle wet, but beyond that there was no harm done at all. After that Mr. Berthon kindly sent us a larger boat, which certainly, for our purpose, answered very much better. The boat Mr. Berthon sent, I think, was a similar boat to that used by the Germans. There were two ends and a middle piece, and that we found, for our purpose, was a great deal better, because we had more power for rowing if the horses were not going kind. You want to have considerable storage-power, which, in a smaller boat, we do not get. With a larger boat we may have more men rowing, and the boat could be pulled round much easier. With that boat we were able to take six, and occasionally even eight, horses at a time over the river. The boat, I think, could not possibly have worked better.

Major RAWSON R.E.: I have been asked to say a few words on this subject, and, in doing so, permit me to say that I am extremely pleased to see Mr. Berthon here this afternoon looking as well as he is. I wish more Englishmen would come to our assistance as he has done with inventions of this sort. It is, indeed, a great pleasure to have Mr. Berthon's boat brought prominently before us once again. He has alluded to some work of the R.E. Committee, and it is from that point of view that I approach the subject this afternoon, because I know what the Committee have been and are doing. I am sure he will not mind my saying that, from his remarks, you might be led to think that the Committee have not been considering Mr. Berthon's boat in the way that they ought. Mr. Berthon, in his paper, says, "The trials (before the Committee) were perfectly successful, and a wagon, weighing five tons, was drawn across by four horses, and there the matter ended, so far as our own country is concerned." The matter, I hope, is not ended by any means. The Committee for a great number of years have had their eye on this boat. As early as 1876 they began experimenting with it; and they are at the present moment getting from Mr. Berthon boats to carry on trials in connection with cavalry operations; so that, as far as the trials he referred to are concerned, I hope they are very far from ended. I should like to get some opinion from Mr. Berthon on the question of repairs. He does not touch upon that in his address. One knows from experience in Canada that the boats there—not the dug-out canoes, but the birch-bark canoes—are repaired very rapidly; and I presume there must be some system of repairing these boats very rapidly. If Mr. Berthon would kindly give us some information upon that head, we should all be very much pleased. I notice that the latest boat which he mentions, a boat 10 feet long, in two halves, and 3 feet 6 inches wide when collapsed, weighs about 80 lbs., and he seems to have made very little alteration upon the boat he originally put forward in 1876. That was a 9-foot boat, and when closed 2 feet 3 inches deep, 6 inches in width, and weighing about 80 lbs. At that time the R.E. Committee put before him this suggestion: "Can you produce us a shorter boat which can be carried on a pack-saddle?" Apparently, Mr. Berthon did not see his way to doing that at the time, but the boat he now brings before us is 10 feet long (a foot longer than the other one) and 3 feet 6 inches deep, instead of 2 feet 3 inches, and its width 7 inches, instead of 6 inches. There is, you will see, very little alteration there; but it is in the wrong direction.[1] The Committee, I know, went on with his 14-foot duplex boats, as he called them in 1881, and they went on with a 12-foot, 20-foot, and 22-foot boat—in fact, they carried on a great many experiments with his boats, so I may say that the matter was not lost sight of during all these years,

[1] The boats supplied to the Royal Engineers many years ago were 9 feet long and 4 feet 3 inches wide. They weighed about 140 lbs., and when collapsed they were 10 inches thick.—E. L. B.

and is, I know, not being lost sight of now. He has also touched on the question of his superstructure in comparison with ours. Major Dickinson showed us that our baulks are really jacks-of-all-trades. You cannot have a baulk of a particular pattern which is not useful all round. I think that is really the reason for retaining the rectangular baulk; but, in addition to that, is Mr. Berthon quite satisfied that his fish-bellied baulk is a good baulk when he has not got a level roadway? You are liable to have your boats tilted in many ways, and you may get strains which will bear on his fish-bellied baulk in an unsatisfactory way, and in consequence a rectangular baulk will probably come off rather the best. I notice in the superstructure of the raft for ferrying guns, shown in a previous plate, a model of which he puts before us, that he has added in the model a strong rectangular frame on the shore end. It is necessary to add that, because in running a gun on from the shore, unless you have something to keep the baulks from being at different levels, you get an unequal distribution; you get either the bow end or the stern end a little down, and you get the gun tilted over, which may cause the boat to capsize. I have no doubt that the rectangular frame must be added for that purpose. Notwithstanding what I have said I am exceedingly glad to see Mr. Berthon here, and that the question of his collapsible boats for certain cavalry and horse artillery purposes has been brought prominently before us.[1]

Sir ARTHUR GRANT: The question of Mr. Berthon's boats taking the ground has been raised. Perhaps I may be allowed to say that I saw one of them take the ground once on a hard, gravelly bottom, with a large number of men and heavy weights, representing guns, in her, and she received no harm whatever.

Colonel CAVE: I do not think that we have heard anything of the relative cost of the orthodox system of the Royal Engineers as compared with Mr. Berthon's system. Another point which I do not think has been very much dwelt upon, and which I should like to hear more about, is the compactibility of the thing. That must be an enormous advantage over the huge things which are used in the orthodox train. I fancy I remember seeing guy ropes to be used when going down certain declivities, which I think must be exceedingly difficult to manipulate. [Major DICKINSON: They are never used.] In my opinion compressibility and compactibility are the greatest advantages in this system, and about these we have heard very little. Another point raised by Major Dickinson, I think, has scarcely been fully considered, he spoke of rough usage and the different advantages of the two systems in rough usage. Now it seems to me that—especially bearing in mind how he tells us they very often have to use what we may call unskilled labour—the infantry and troops who may be hard by to assist, what is most likely to happen under these circumstances is, that the boats will be let fall. I cannot help thinking that if a wooden boat falls, it is far more likely to sustain injury than one of these canvas boats; and, therefore, looking at durability from this point of view, surely there is in Mr. Berthon's system a decided advantage and not disadvantage. Another point of comparison, but one which I did not quite catch, had reference to the relative amount of floatability of the one system compared with the weight. In a ton of this material I should imagine that there would be a great deal more floatability than in a ton of other material. That is a point of comparison about which I should like to hear Mr. Berthon's and Major Dickinson's opinions.

Major-General TULLOCH: I have had something to do with the use of this boat for troop service at sea, and I must say the satisfaction one always feels when one sees these Berthon boats on board ship is very great. In the Indian troopships in former days we had nothing but very large pontoons, so big that if any accident

[1] The little rectangular frame is no part of the equipment, it merely represents (in the model) the shore from which the bridge starts. The chesses hooked into the side baulks keep the whole properly together.—E. L. B.

happened it was patent to everyone that they could not be got out. Nevertheless, they were turned to a useful account—they were made receptacles for potatoes, and during long voyages they were found extremely useful for that purpose. In both private ships and on board Government ships it has always been an immense satisfaction to look over the side and see three or four of these large Berthon boats stowed away. On board large passenger ships I have often looked at the number of boats and calculated how many people it would be possible to save in case of accident, and I have come to the conclusion that in many cases we should have come to very great grief indeed. In coming home on the last occasion it was with very great satisfaction that I saw these very large Berthon boats made use of by the P. and O. Company. I never had the pleasure of meeting Mr. Berthon before, but I am exceedingly pleased in now having seen the man who has done so much for the benefit of the people who have to go to sea.

Mr. JAMES: As a rival of Mr. Berthon, I may say that I had one of his boats for five years. Major Dickinson was asking as to the durability of the canvas. The durability of the canvas was proved to me when I saw Mr. Berthon's boat, because I used to keep the one I had on a very rough shore, where there was broken glass and piles. I used to leave the boat there continually, and I had it for four or five years, and it never got a hole through it. The convenience of a canvas boat struck me so much that I designed one myself, only it had a single skin. As Captain Fergusson has said, if you have got a hole in it you can easily stop it up with a pocket-handkerchief, and that, perhaps, is simpler than having a double skin.

Rev. E. L. BERTHON, in reply, said:—I should like to make one or two remarks upon what Major Dickinson so kindly said. With reference to the advantages of my boats, I do not think he mentioned two. With respect to the bridge, we can make a bridge 40 feet long, and the light bridge will carry the heaviest field gun or anything up to three tons. That is one thing. Another thing is with reference to the rafts. I not only have a very heavy raft that will carry six tons or more on one wagon, but I can make it into two separate rafts, which will carry a wagon; or, by having a 6-foot roadway, I can carry two sets of military carriages, guns, and other things. That is an advantage which I have with my system. Then there is the question of making holes in these boats. I grant that if you took a knife, or any sharp thing, you could make a hole in the canvas boat more easily than in a wooden boat. Captain Fergusson has told us of a horse having kicked his foot through one of these boats. What would have occurred if the boat had been made of wood? The horse would have kicked a hole through it. Would any boat stand the kick of a horse? Then there is the question of holes being made in the boat owing to its going on the rocks. Hundreds and hundreds of times we have driven these boats against rocks, pier-heads, and shingle beaches, and almost all things, without any danger. A little while ago we had a letter from a gentleman in Australia who said that he had one of these boats. He was anchored some distance from shore—I think it was not far from Sydney—and he did not take the boat on board. It came on to blow very hard during the night, the painter broke, and the boat drifted ashore on to a rock and thumped about all night long. When the gale ceased they thought they would go and pick up the pieces which were left. They found, however, that the boat was just as good as it was before. There was not the slightest injury. If it had been a wooden boat the timbers would have been shaken out of her, but as it was there were no sharp points to the rocks, and there was no hole made through the canvas. That was owing to the elasticity; but had it been a wooden boat, and the timbers struck against the rock, of course she would have gone to pieces. I once knocked a hole through a door with one of these models. At Port Elizabeth I once threw one of these boats off the dock of a ship—I threw it right over the taffrail on the water, and it was not hurt in the slightest—the boat

was 20 feet long. You could not do that sort of thing with a wooden boat. With respect to repairs, they, I may say, are extremely easily made. One speaker has mentioned a point under the shore end of the superstructure, that it wants something on the shore to keep the ends in the right position. That, however, is not the case. I can show you a pair of my chesses and you will see that each of the chesses is provided with a claw which goes into the side of the baulk. There are no ribands. I should like the officers of the Royal Engineers to see this and say what they think of it. It does away with racking, and we get a very neat contrivance without it. The whole thing is all kept together. I should like to mention the question of materials. Some twelve or fourteen years ago we had to make some slight superstructures for the R.E. Committee. They insisted upon their being made of Kauri pine. We replied that Kauri pine was not in the market and that it would be extremely dear to have it sent over. Thereupon they sent me a very choice piece of Kauri pine, and we had the things made. One day one of our foremen came to me and said, "Look at this stuff, sir." I said, "It does not look very good." So we had a bar made, and then took up the first piece of yellow deal we found, and made another bar exactly the same size and same shape. We then put them at the the same distance apart, as supports, and tested them by weight. We found the common deal was 20 per cent. stronger than the Kauri pine! Why, then, have that very expensive material? It could not have been a bad bit; it was a choice bit sent from Chatham on purpose. There is another thing that I should like to say, and I think it is very important, and that is with reference to galvanised iron. Galvanised iron comes a great deal into use in all our very simple hinges. We never find them go wrong now, and we never have an accident with them at all. If, however, I was to send that iron to any galvaniser in England I should have no confidence in it. It is well known in the Service, and also in the Civil Service, that galvanised iron loses something like 23 or 24 per cent. of its strength in galvanising. This is a very important thing, and I should like gentlemen present to know it. I sent about to more than one place to try and find out what the cause was. I was told that it could not be explained, but so it was. I determined to try another thing. I can assure you that our iron is improved by being galvanised. It should be "galvinised," not "galvanised"—it is an "i" and not an "a"—it is "galvinised," from Galvin, the Frenchman. In all the works that take iron to be galvanised, some clean, some dirty, and some in a middle state, they pitch it all into the bath of diluted hydrochloric acid, and leave it there for about twelve or fourteen hours. The chemical action upon the surface of the iron has the same crystallising effect upon the iron itself as certain conditions of climate will have upon railway wheels and axles, and so forth—they become crystallised and break. If, however, the iron is moderately clean before it goes into the bath and is only allowed to remain there two minutes, that is quite enough. Then you take it, galvanise it, and let it cool gradually, and it will be found to be much better than it was before. That, I think, is a most important thing. I do not know whether any members of the R.E. Committee or others know this circumstance. I have mentioned it once or twice before, but I think it is worth considering, and I take this opportunity of again mentioning it.

Major RAWSON: You have told us that the repairs are easily carried out: I should like to know how they are carried out. Do you paste on a piece of skin?

Rev. E. L. BERTHON: We have published a little sheet giving directions how to make repairs. There is a way of making almost instantaneous repairs, and there is another way by which a sailmaker, or anybody else who understands the use of a needle, can do it. You then apply some of our flexible paint over it, and the repairs are easily made. I hope what I have said about anchors, kedges, and so forth has not been out of place. I cannot help thinking that kedges would be a very good substitute for anchors. I quite agree with what Major Dickinson said about the effect of wind. As far as stream was concerned that is so, but with

very strong winds we should want the same ratio, as in the case of the ordinary pontoon.

Colonel CAVE: Can you give us the relative cost?

Rev. E. L. BERTHON: The pontoons which I have been sending to Germany I think are forty-one guineas each.

Colonel CAVE: What is the cost of a wooden pontoon?

Rev. E. L. BERTHON: I do not know, but perhaps Major Dickinson could tell us. I should like to make a few more observations upon what has been said by him. I do not think the present audience will conclude that what I claim as the chief advantage of my system consists in putting the pontoons for bridge work closer together. The real merit is in carrying *double the number* on a wagon, and reducing the length of the load from 21 feet to 12 feet. As to the utility of 15-foot baulks mentioned by Major Dickinson, if made *fish-bellied*, with 2 feet 6 inches of rectangle at each end, they could be used of any length from 10 feet, and weigh far less. It must be remembered too that I have *twelve* baulks, instead of only five; mine weigh 31 lbs. each, and are *very* much stronger than the Service baulks weighing 84 lbs. Connected with this point, Major Dickinson has told us that by using half-pontoons he can make a narrow bridge of twice the length. I grant that placing the chesses diagonally there would be enough of planking for a road 4 feet 6 inches wide; but for guns, etc., it must be 6 feet wide. But as there must be at least three baulks and two ribands to each bay, one of the former and two of the latter would be wanted, adding 238 lbs. to the load. In my narrow bridge the chesses placed longitudinally and resting on the saddles do duty as bearers, with the addition of a baulk on each side connected by short cross pieces; this has been tested up to 4 tons. I do not think Major Dickinson took cognizance of the fact that I carry a pontoon bridge of one-third greater length, and, at least, two-thirds more displacement, on a given number of wagons, than in the Service team; and that, moreover, my wagon load will be only a little more than half the length, and the wagon itself lighter. One Service wagon and unit complete cannot make a raft. My wagon and unit complete will make a raft for two guns and limbers, or two heavy wagons. Some officers present have kindly (and generally in favour) remarked upon the durability of these boats, and of canvas in particular. We have in our yard a 22-foot boat which was built in 1879. This boat has been in nearly all the European exhibitions, has been used many years at sea in all climates, and except four times painting it has had *not a farthing's worth* of repair; yet the canvas is as sound as ever. It is still on a ship's side under davits, and has never been under cover except when it was exhibited at the "Fisheries."

Major DICKINSON: I do not know.

Major RAWSON: A new pattern 21-foot pontoon, as manufactured at the Arsenal, would cost a great deal less than one made at Portsmouth, where, I understand, the private tender comes out at something like £60 apiece. That, of course, is done by outside labour.

The CHAIRMAN: Ladies and gentlemen,—Allow me, in the first place, to say what a satisfaction it has been to me—one of the oldest members of the Royal United Service Institution—to be in the Chair for the first time in this fine Theatre, so different from the place we have been accustomed to. This building is so pleasantly and well arranged, and has such a beautiful Library, and is altogether so adapted to the object for which this Institution was created, that I do hope the officers of the Army and Navy in large numbers will subscribe the comparatively small sum to belong to it and make use of it. I am sure it will be of the greatest possible service to the officers of the Army and Navy to have such a Library as this, and to come here and hear the lectures, which I have no doubt will be of great value in the future to them as they have been in the past. I cannot speak much

from a scientific point of view with regard to the lecture which we have heard to-day, as the question of the transport of armies is hardly within my province. I have rather looked at this question from a cavalry and horse artillery point of view. It is some years ago—I think about seven—since the Duke of Connaught wrote to me from Germany to say that he had seen a system carried out whereby a division of cavalry crossed a river in a new way, under an officer of the Ziethen Hussars. The horses swam alongside the boats, the men holding on to the head-collars—the horses pulling the boats across. The Duke had been very much struck by this, and afterwards wrote to me on the subject of Mr. Berthon's boats, as he was very much interested in what he saw of them at Portsmouth. It is really to the Duke of Connaught, I think, that we owe the fact that Mr. Berthon is here to-day and given us his views. He has always taken the greatest interest in the subject, and I was reading one of his letters only to-day, in which he said he hoped that I, as Inspector-General of the Cavalry, would take up the subject, and that he would be able to obtain permission to try the boats at Aldershot. I have frequently been present at the German manœuvres. I was at Mayence three or four years ago, and a German cavalry general, who had been A.D.C. to the famous American confederate, General Stuart, said to me, "You are very lucky in England; you have that capital plan of crossing rivers for your cavalry, the collapsible boat. You were kind enough to send one to us, and we are now getting them altogether, I believe." I asked what it was, and said that I had never heard of it. He said, "Surely you have it, because we have it. We have them in our cavalry regiments. We have a few now, and we are going to have more of them. You were very lucky to get them before." I had to explain to him that I had never even heard of them, and it was only after I became very much interested in the subject and corresponded with Mr. Berthon, and went down last year to see them, in connection with the artillery and crossing the river, that I became convinced of the advantage of having these boats for cavalry and horse artillery. It is necessary to have light transport. What is the good of having the finest cavalry in the world, if you come to a small river and cannot get across it? There seems to be a strange belief among the people in England—at least, I have often read it—that cavalry ought to be able to jump into a river, swim to the other side, and thus cross the river. That is not the way that armies cross rivers. With a heavy equipment the men would probably be drowned—at least, very few of them would be able to get across. A man very likely could swim with his horse, with his carbine and a light kit, but he could not possibly carry his cloak and forage. It is only exceptional horses and exceptional men that could possibly do it; both men and horses must be good swimmers. A patrol, perhaps, might be got across in that way. I know that in 1813 the Russians crossed the Elbe in boats, holding on to their horses in the same way as the Germans do now. When I was in Germany I spoke to two Inspector-Generals of Cavalry, and one of them, General von Rosenberg, said that the *only* way was to have boats and cross over with the horses alongside, the men and kits being inside the boats. When you come to small rivers and small water-courses no doubt there are many ways of crossing. During the last two or three years in England we have taken up this subject of crossing rivers much more than before, and the necessity has been recognised by regiments. They have responded so far as they have been able, but it has been a difficult matter, as they have said that they had no money, but that if they could get money to hire or buy boats they could do a great deal more. I am glad to say that by degrees we are getting a small allowance, so that we have been able to hire boats for cavalry practice in the crossing of rivers. Captain Rivington's system of eight corn sacks has been referred to. The raft will carry 1,200 lbs. With regard to the trial of Mr. Berthon's boats by the cavalry, I may mention that he was kind enough to lend one to the Royal Horse

Guards at Windsor. I can only repeat what Captain Fergusson has told you. On an outpost reconnoitring day of the Blues, I went down to see them in the morning before the people were about. The patrol of the Blues arrived at the Brocas at Eton. When they got there they were supposed to find that Windsor Bridge had been blown up. The officer and the men took off their things, got on their horses, and swam them across to the other side. I think there were in all half-a-dozen men and the officer. Arriving at the other side they found a Berthon boat and two ordinary punts, which had been placed there on purpose. They brought the boat and the two punts across, which I think took them altogether about eight minutes. They then took their kits into one punt, and by that time the squadron had arrived. They crossed over themselves, and went right away on with the patrol. When the squadron came up the men dismounted, put their kits into the Berthon boat, led their horses alongside, and when they got a good many alongside the boat the others followed. The river was thus crossed, and the whole squadron was mounted again and away on the other side in twenty-five minutes, and reconnoitred the country towards Bagshot. The operation, I believe, was performed afterwards in a quarter of an hour. Nothing could have been more practical or better done. Many other regiments have tried to do the same thing with boats. I wish each regiment could have a Berthon boat. The Germans have them, but they have at the same time a heavy wagon with four horses. I know that Colonel Lonsdale Hale takes a different view from that which I take, but I myself like a light cart. I think where cavalry can go, horse artillery can go or ought to go. I do think that a little horse boat would be most useful in getting three or four men across, for if you can get three or four men across more can follow. If Wilson's party in South Africa had had a boat of that description, undoubtedly they would have been saved. For the large boats for cavalry, I think, you must have something like the system shown on the light cart. The pontoons at present in use are enormously heavy, and it would be quite out of possibility to use them with cavalry. I do not see, also, how you could turn them round in a lane or narrow road. I think we must all feel grateful to Mr. Berthon for coming here and giving us this most interesting lecture. There is only one regret that I have, that he is not a soldier. Anybody who has heard him speak here can see what sort of a man he is and what a good soldier he would have made, and how useful he would have been to us. I have great pleasure in proposing a vote of thanks to him.

Colonel CAVE: I have great pleasure in seconding this vote of thanks. Although Mr. Berthon is not a soldier, I can testify that most of his people are Volunteers.

The vote was carried by acclamation.

Rev. E. L. BERTHON: I feel very grateful for your kindness in passing this vote of thanks to me. It has given me great pleasure to lecture before such a distinguished audience as this. There are one or two things I should like to say. As to being a clergyman and doing things of this kind, perhaps you may quote, *Ne sutor ultra crepidam:* "Let the cobbler stick to his last," and the clergyman stick to his sermon. I think it has been remarked that a clergyman as a civilian, and as a professional, ought to have nothing to do with military matters—least of all ought he to try to improve engines of war or anything that makes war destructive. Now, I do not hold with that view, and I will tell you why. I think that everything which tends to make war more destructive tends to bring it to an end more quickly, and, therefore, in the end diminishes the great suffering which is caused by it. Who is it that suffers most—the men who go at the expense of their bodies, or the poor wives and children who are left at home? I do think if it pleases God to put it in the mind of a clergyman to do something of this kind that he would be guilty of a dereliction of duty if he did not bring it forward. I know that there is a difference of opinion between the

Chairman and another excellent speaker, that one should embrace the boats or carts that can only go along moderate roads where horse artillery can go. But the other can go wherever cavalry can go, over ditches, hedges, and everything else. Another point has struck me since I came into this building. The cart weighs only 12 cwt., and the boat with the saddle and everything else weighs only 98 lbs. Why should not you put them together, and having two horses to the cart you can then have that cart following horse artillery or cavalry as far as the road is practicable; and when you want to go across country and come to a river you can put the light boat on one of the horses, the other being quite enough to deal with the cart alone, and you have the two things complete. You will notice in the raft that I have shown, that not only will it carry a gun up to 3 tons, but by placing the skids as I do there is sitting room for no less than forty men.

THE HYDRAULIC GUN MOUNTINGS OF FRENCH SHIPS.

By GUSTAV SCHWANDA, Royal Marine Artillery Engineer.

Translated by permission from the "MITTHEILUNGEN AUS DEM GEBIETE DES SEEWESENS."

By T. J. HADDY, Staff Engineer, R.N.

HYDRAULIC gun mountings present so many extraordinarily interesting details of construction that a description of them attracts and rewards us even now, although there is a constant retrograde movement taking place in such fittings towards the employment of hand power or electricity. In the fittings to be described principles are involved and arrangements made fundamentally different from those in general use.

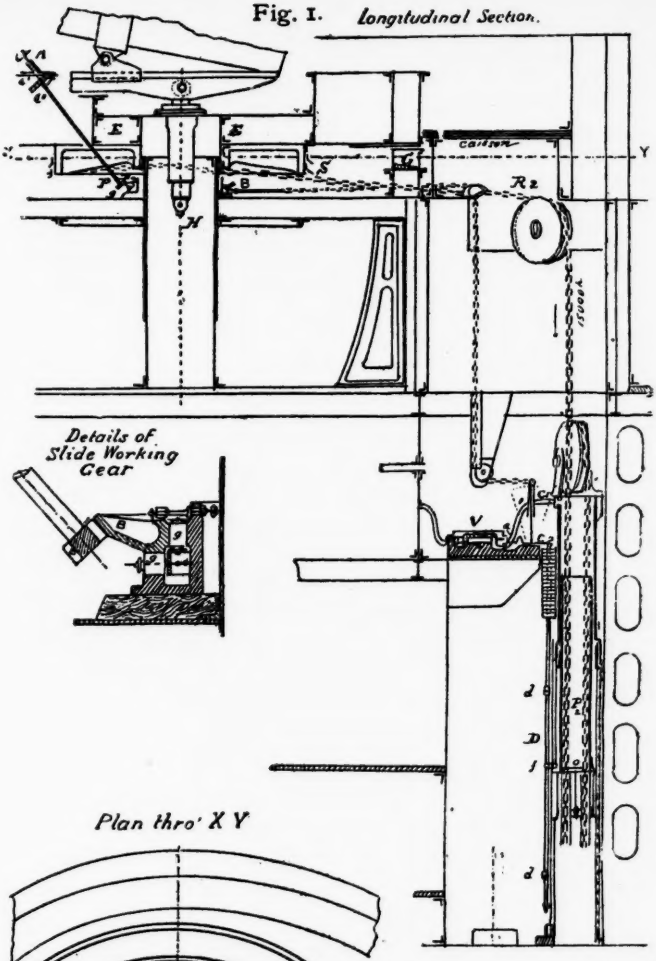
First of these may be mentioned the numerous safety arrangements in the hydraulic fittings. In the French Navy there appears to be very little of that reliance on the intelligence, firmness, and coolness of the gun's crew, which is a fighting factor claimed by most constructors of other Powers, all the hydraulic gun mountings presenting safety arrangements which rigidly prescribe the routine for working the gun, and in most cases render any departure from this routine either impossible or very difficult, so that any mistake on the part of the gun's crew is at once made evident. Another leading principle in the construction is the ammunition hoist through the central pivot tube, and the vertical and oblique sliding guides for the carriage, so that it is brought fair with, and close to, the breech of the gun. The loading can be carried out independently of the training, as the carriage revolves with the gun platform in the central pivot tube. The delay and inconvenience of training the gun after every shot is obviated, the elevation only requiring adjustment. In conjunction with this arrangement hand power only is used for placing and loading the gun (see the installation of the 27-centimetre gun, "Acheron" type), as the fitting of an hydraulic rammer would necessitate two additional pipes at least through the central pivot. This, however, has already been done in later installations. The training arrangement must also be mentioned, as this is always worked from outside by means of a central drum around which two chains are wound, set in movement by two hydraulic presses; this affords a considerable saving of weight in construction, as the arrangement of the chain presses is a very convenient one, and the leading of the necessary chains presents no difficulties. Another advantage of this construction is the security of this important mechanism against gun fire, as it is generally placed under the gun platform, often under the protective deck, and nearly always under the water line, and consequently is not nearly so much exposed to the enemy's fire as is the

case with the English and German systems. Very large calibres also require hydraulic arrangements for opening and closing the breech, and this is generally effected by one or two small cylinders, which work as single or double acting machines for this purpose. The utmost possible employment of the power at hand is here, however, most prominently shown, and it would be in no way impossible to employ hand-power for this purpose, as has been proved in the case of slightly smaller, and also with guns of similar calibres.

Two conditions must be mentioned as specially characteristic of the French installations, namely, the employment of accumulators (Kraft-sammler und Vervielfältiger) for the hydraulic pumps, and the use of counterbalance weights for the hand levers in order to ensure their automatic and correct return on one side, and to counteract the weight of the numerous connecting rods, etc., on the other. These fittings will be mentioned in their proper places. The hydraulic installations for ships built up to 1885 are supplied by the Farcot Works, whilst the later installations on the Canet system are, for the most part, from the works of the Forges et Chantiers de la Méditerranée. On many ships separate parts have been supplied by various establishments who have contracted to supply of their best. In the following examples a Farcot installation of the "Caïman" or "Indomptable" type, to which also the "Terrible" and "Requin" belong, will be treated of, and a Canet installation as fitted on the "Marceau," with which that fitted on the well-known Spanish battle-ship "Pelayo" is identical. The hydraulic machinery of the 42-centimetre, 22-calibre long (16·6-inch, 76·8-ton) guns of the "Requin," "Indomptable," "Caïman," and "Terrible" will be described in the following order:—1. Training apparatus. 2. Loading apparatus. 3. Breech mechanism. 4. Running-in-and-out mechanism. 5. Elevating and lowering mechanism. 6. Safety firing arrangements.

1. *Training Apparatus* (see Fig. 1).—The training wheel A on the shaft a' a'' works the toothed wheel B by means of the pinion P; the arms $T\,T'$ on B work the slide valve V by means of the chains connecting the arms $T\,T'$ to the valve spindle and balance weight, and in this way the hydraulic presses $P_1\,P_2$ are either filled or emptied, according to the position of the slide. The toothed wheel or collar B is carefully fitted with horizontal and vertical friction rollers g and g', and works loosely on its axis. The arms $T\,T'$ are fixed at opposite points, T being connected to the slide, while the other, T', carries a counter-balance weight of 182 kilogrammes; the slide valve is fitted with a recoil valve, and its construction possesses nothing worthy of mention. The training is effected by two ordinary hydraulic presses carrying chain pulleys at the ram heads, the action being that of an inverted single purchase, the power being applied where the weight would be in the ordinary chain purchase, a common and well-known application of hydraulic power. On the slide valve spindle V is a bell crank $C_1\,C_2$, whose vertical arm C_1 is connected to the direction chain T, whilst the horizontal arm C_2 carries a chain and balance weight so as to keep the direction chain continually in tension. On the arm C_2 there is

Fig. 1. *Longitudinal Section.*



also a guide bar *D*, on which a tripper *f*, worked by the press P_1, slides, so that when this tripper comes into contact with one of the stop pieces *d* on the guide bar *D*, it is either raised or lowered, and the slide valve *V* is brought to the middle position, this forming the automatic stopping gear of the training apparatus.

The gun is supported on the movable platform *E*, which revolves on the axis *H* and the rollers *G*. The two training chains R_1 R_2 are secured to the drum *S* at the points M_1 M_2, and the action is as follows :—By means of the hand-wheel *A* and its connections the toothed ring *B* is revolved and the slide valve opened to the supply for one of the training cylinders, and, at the same time, to the exhaust for the other; the pistons begin their movement and revolve the platform in the contrary direction to that of the toothed wheel *B*, which stands fast during this movement of the platform and causes the hand-wheel *A* to revolve, the movement of which is followed up by the operator, and any tendency to stop at once checked by slight pressure on the wheel. In order to stop the training of the gun platform it is only necessary to hold fast the hand-wheel, when, by the continuation of the movement of the platform the ring *B* is moved and the slide valve brought to its middle position.

2. *Loading.*—All movements of the loading apparatus are effected by hydraulic power; the fittings for this purpose forming the most elaborate and complicated parts of the construction, it will, therefore, be necessary to describe them separately in the following order :—*a* the ammunition carriage, *b* the rammer, *c* the locking bolt, and *d* the breech apparatus. The carriage *M* (Figs. *a* and *c*, Table I.) consists of three tubes, the upper one taking the projectile and each of the two lower a half-cartridge, all three holders being lined with wood, the upper one having in addition a copper seating on which the projectile rests. A buffer is fitted at the after end of each holder, that for the projectile of indiarubber and those for the cartridge of wood. At the foot of the carriage is the crosshead *K*, to the ends of which are attached the chains from the hoisting ram *Pm*, and at the upper part of the carriage is a wooden structure *dm* designed for opening the cover of the ammunition tube, and also the small iron arm *l'm* for shutting this cover as the carriage is lowered. The carriage is guided in its movements by the two guide bars *bm* and the guides *am*; at the upper end of these guides there are three steps, e_1, e_2, e_3, giving the three positions for "projectile" and first and second halves of the cartridge; a fourth step, e_4, limits the hoist of the carriage. The distribution slide *Tm* of the lifting rams *Pm* is worked by the hand lever *lm*; *gm* is the water-pressure supply opening, and which also serves for the exhaust if the other cylinder of the press is in action. The pistons are guided by the guide bars *nn*; a counter-balance weight of 12 kilogrammes is attached to the valve rod to balance the connecting rods and gear. In the combined supply and return tube *tm* there is an automatic disconnecting apparatus for cutting off the pressure supply when the carriage has reached its bottom position. At each side of the carriage there is a bolt *O* fitted to the casing of the tube, the ends of the bolt gearing into toothed racks or quadrants *io*. The axis of both the

quadrants is connected with the lever I_1 I_2 (bolt levers); the travel of the bolt longitudinally is limited; on one side projects the arm *Ko*, which carries a weight of 90 kilogrammes suspended by a chain, the chain being connected to the safety arm *S* by the arm *Sa*. As these bolts are fitted in guides and have a travel of 30 millimetres in a vertical direction, the blow of the carriage will lift them by this amount and also the chain and weight, and the arm *Sa* will be lifted, causing the safety arm *S* to be revolved. The rod I_1 I_2 has a small projection *Ie* which works the small arm of the lever *H*, the object of which will be explained in describing the rammer. The safety lever *S* has three arms—*Sa* fixed to the bolt chain; *Sb* enables the slide *Tm* to be fixed when it lies on the slide rod t_1; *Sc* fixes the slide *Tr* of the rammer when its end lies on r_1 of this slide rod.

The rammer (Table I., Fig. *a*) consists of seven wooden rollers *R*, connected together by curved bars, so that the whole can travel in a circular or curved path; it is actuated by an hydraulic press *Pr*, of similar construction to other presses of its kind. The upward movement is partly controlled by the resistance on loading, and partly by the lever *H*. When the telescopic tubes are out at their full extent the projection *d* has also arrived at its extreme position, that is, at the inner rim of the packing gland of the outside cylinder and the end of the inside cylinder *p'*, at the head *cr* of the rod *fr*. In this installation the chief point requiring attention is the packing of the glands, which must be only packed sufficiently tightly to prevent the rammer from descending too quickly, the return movement being effected by its weight alone. The water pressure is led to the press through the pipe *tr*, which also leads to the valve *Tr*. The before-mentioned stopping lever *H* has its projecting end *nh* between the connecting links of the rollers, and the outer arm *Sh* in a fork of the hand lever rod. The weight of the crank lever is balanced by the counter-weight *ph*. The slide valve rod carries three (so-called) safety arms: r_1 serves for opening the valve if the loading carriage is in either of its three loading positions; r_2 carries a counter-balance weight of 90 kilogrammes for the rods; r_3 is divided into two smaller arms, one of which carries a balance weight, whilst the other gears in the eye of a press *Z*, called the "safety press of the loading gear." This is fitted in the lead of pressure pipes from the valve to the rammer press *Pr*, and serves to regulate the pressure in accordance with the work required, and to cut it off after the three loading operations have been performed. The safety press is a small cylinder, whose piston is loaded by a volute spring to 30 kilogrammes, so that the pressure in the supply pipe can rise to 50 atmospheres.

The "stop bolt" (Fig. *a*, Table I., and Fig. 2) holds the platform in

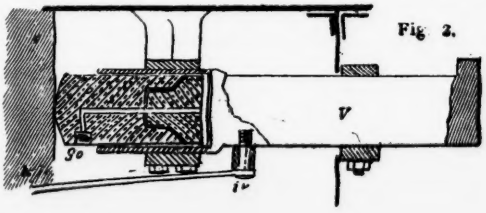


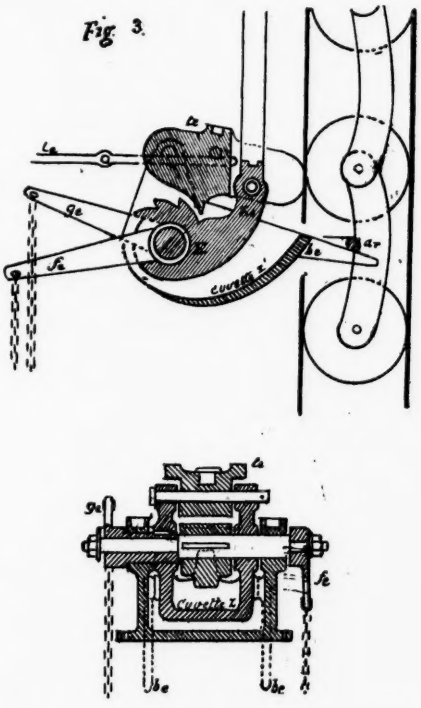
Fig. 2.

the loading position, and consists of a fixed piston *Pv* fitting in the cylindrical end of the stop bolt *V*; the water pressure passes through the supply opening *gv*, which also serves for the exhaust passage. At *iv* is a safety rod l_6, the other end of which works on the finger l_3 of the carriage lever *lm*, so that if the platform is not fixed by the stop bolt in the loading position, the lever *lm* cannot be worked. The distribution valve *Tv* of the bolt is underneath, by the valve for the carriage, and is worked by the hand lever *lv* from the platform deck by a chain connection. A counter-balance of 25 kilogrammes equals the weight of the rods and chain. On the movable platform is a counter-bolt formed of three parts, and when the stop bolt is forward or in gear it compresses the counter-bolt against the volute spring *W*, and also causes it to enter a hole in the elevating position rod *Gv*, in order to secure the elevating position whilst loading, as well as the training. The counter-bolt has two arms, one of which carries a counterpoise, and the other is in connection with the breech-opening apparatus. In addition to this, the counter-bolt is geared to a crank arm *uou'* with a rod leading to the running-in-and-out apparatus, and which holds the gun firmly in the loading position (Table I., Figs. *a* and *b*). The breech-closing apparatus consists of two simple-acting presses, Y_1 Y_2, fixed parallel to and supporting each other. The water pressure is supplied to them by the pipes ty_1 and ty_2. Each piston rod is fitted with a crosshead, and the two are connected by a pitch chain passing over the sprocket wheel *Ay*. On one of the piston rods is an arm *Ky*, to which the above-mentioned chain *Cy* from the counter-bolt of the platform is secured. The distribution slide *Ty* of both presses is above, on the platform, and is worked by the hand lever *ly*, and on the valve rod *qy* a safety crank *by* is fitted, the two arms of which can rest against projections on the counter-bolt. The loading is effected as follows:—If the gun is in the loading position, the lever *lm* of the ammunition hoist is pushed forward, the crank arms l_1 l_2 move the slide *Tm*, and the lever *le*, connected at *S'*, releases the catch *y*, which drops by its own weight, allowing the catch *te* to gear in the toothed segment of the arm *Ke*, and the carriage begins its upward movement.

When the projection e_1 of the guide *am* of the carriage reaches the bolt *O*, this is lifted the small distance allowed in the guide *go* and the carriage is brought to rest; in this position the projectile is in line with the bore of the gun. When the bolt *Ko* is pressed upwards it also lifts the point of attachment of the safety lever *Sa* of the rammer and revolves the safety rod *S* a very small amount, but just sufficient to press the safety arm *Sb* against the valve rod of the carriage, and so fix it, and, at the same time, lifts the safety arm *Sc* from the bell crank r_4, and sets the valve rod of the rammer free. By this means it is now impossible to move the carriage, but the rammer can be worked as required. If the lever *lr* for the rammer is now pulled back and the valve *Tr* opened, the lever *rg*, which is fitted with a small counter-balance weight, is also moved, and frees the slot of the safety press *Z*. The upward movement of the rammer now begins, and ceases only on completing the loading of the projectile. The forked lever *be* of the catch arrangement *E* (shown

plainer in Fig. 3) carries at its other end, secured at *ge*, a balance weight of 140 kilogrammes, which causes it to follow the movement of the rammer and reach its highest position, when the catch *te* falls into the first tooth of the sector *E*. If the projectile is now home and the rammer

Fig. 3.



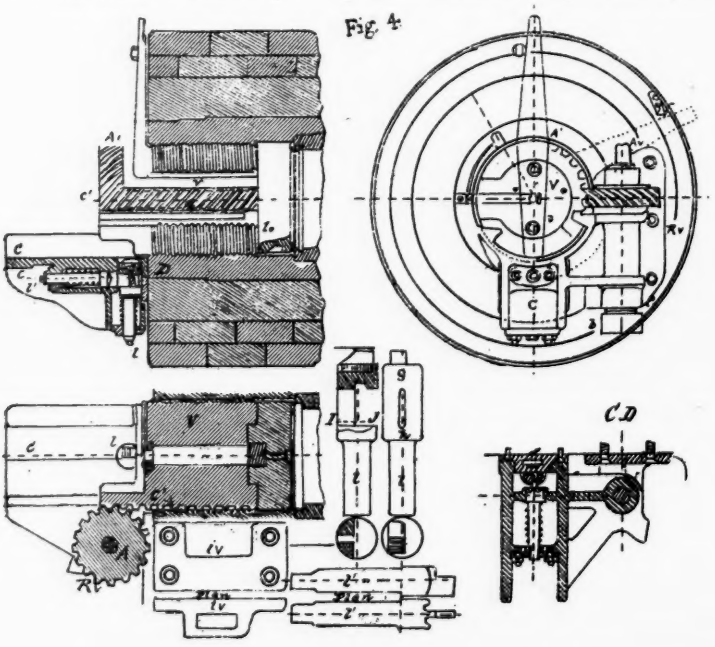
come to rest, the pressure in the little safety press *Z* rises from 25 kilogrammes to 50 kilogrammes, the piston of the press compresses the volute spring and brings the slot of the piston rod in front of the lever *rg*, which drops in gear and allows the slide to be opened for the return; when this is done, the rammer sinks by its own weight, the projection *ar* strikes against the arms *be* of the catch apparatus and causes the catch holder *z'* to revolve on its axis; the catch *te* follows this movement and presses back the toothed sector by the arm *Ke* and moves the rods I_1 I_2 downwards.

By this movement the projection *Ie* strikes against the arm *Sh* of the crank-arm *H* on the bearing *Oh*, and pressing it down causes the other arm *nh* of this lever to project to about the centre of the rammer channel. By the downward movement of the rods I_1 I_2 the bolt *Ko* is drawn back somewhat through the small-toothed segment *io*, and falls away under the action of the balance-weight from the first step e_1, of the

ammunition carriage, by which means the safety arm returns to its original position, freeing the slide valve of the hoist and fixing that of the rammer. If the lever *lm* is now again placed in the working position, the carriage will rise till the second step e_2 strikes against the bolt *Ko*, the safety arm *S* is again revolved, the valve of the rammer is freed, and that of the carriage fixed; this is the loading position for the first half-cartridge. The rammer is now worked, when the projection *ar* strikes against the projecting arm *nh* of the crank arm *H*, and carries it up against the buffer *B*, bringing the rammer to a standstill. In this position the half-cartridge is pushed out of the carriage, not into the full loaded position, but only in position for loading the second half, and the above movements of the ingeniously-designed mechanism are repeated for the latter, when the two halves are rammed home. After loading, the hoist lever is a fourth time put in action, the carriage rises the small amount necessary to bring the fourth step e_4 up to the limiting piece *Cm*, which causes the bolt again to take up its lower position, revolves the safety arm, releases the slide valve of carriage, and fixes that of the rammer, so that the former valve may be placed in the return position, and the carriage lowered to the magazine. As soon as this is done the levers l_1 l_2 of this slide valve, taking the arm *le* fixed on *S'* also with it, lifts the catch *te* out of gear. The counterbalance weight of 160 kilogrammes lifts the rods I_1 I_2, and pushes the bolt *O* forward to its original position, so that all the movable parts are again restored to their original starting positions.

The Breech Mechanism (see Fig. 4 and Table II., Figs. *a* and *d*).—

Fig. 4.



After the introduction of the heavy 42-centimetre guns, worked entirely by hydraulic power, the same power was also employed for opening and closing the breech, although the construction of the French breech screw is not so well adapted for the application of this power as the wedge system adopted by Messrs. Krupp and others, there being three separate movements in different planes, necessitating the introduction of various mechanical details in the French plan, a short description of the working of which is here given. It consists of an interrupted screw *V*, the forward end of which carries an obturator plate, which bears on a copper ring recessed into the bore. The opening of the breech is effected by first revolving the screw, so as to free the segments of the interrupted thread; it is then withdrawn its whole length and rests on the bearer *C*, which, with the breech screw is swung on one side, leaving the bore free. These movements are effected by two press cylinders V_1 V_2 (Table I., Fig. *b*) fixed parallel to each other under the platform; one of these cylinders serving to open, the other to close the breech; the pitch chain secured to the outer ends of the pistons is geared around a vertical shaft *fv* fitted to the movable platform, and with a forked head at the upper end to receive the *T* head *b* of the shaft *Av* (Figs. 4, and *a* and *d*, Table II.), on the upper end of which the toothed wheel *Rv* is keyed, its teeth at first being in gear with the teeth on the right-hand top side of the projecting part of the breech block, and so causing it to revolve and free the thread; as soon as this occurs the motion is transformed from a revolving to a direct linear one, and the continued revolution of the toothed wheel *Rv* draws out the breech block on to the bearer.

Under the bearer *C* a vertical bolt *l* is fitted, constantly pressed upwards by a spring; and the stop-bridle *iv*, secured to the gun by four screws, bears in a recess of this bolt. On the top of the bolt there is a projection, somewhat out of the centre line, bevelled off at the after side at an angle of 45°, and behind it, in a horizontal position, is a retaining bolt *l'* with a projection at its forward end; this is also kept constantly pressed forward by means of a spring. The manner in which the mechanism above described acts is as follows:—When the breech is closed the nose of the bolt *l* is pressed against the breech *V*; the projection of the keep-bolt *l'* is in a recess of the bolt *l*, and the end of the bolt in contact with the fixed stop-bridle. When the breech is withdrawn, the nose of the bolt *l* enters a recess *lv* of the breech, and by this upward movement of the bolt its hooked end is lifted out of the stop-bridle *iv*, and the bearer can now be revolved. As the breech block can have no further forward motion the continued movement of the cogwheel *Av* (Table I., Fig. *b*) swings back the carrier until its stop-piece takes against the end of the gun. When the carrier is lifted clear of the stop-bridle on the gun, the keep-bolt *l'* is pressed forward by its spring and secures the bolt *l*; it also serves to connect the breech and breech carrier. In closing the breech the other press is brought into play, and the toothed wheel *Av* is turned in the opposite direction, the carrier with the breech block is swung back; as it nears the stop-bridle the keep-bolt *l'* is pushed back, the breech is pushed forward by the wheel *Av*, and at the same time the bolt *l* pressed gently

down until it again springs back into its original position. The pressure supply to the breech presses Y_1 Y_2 is led through the pipes ty_1 ty_2 from the slide valve Ty (Table I., Fig. *b*).

Apparatus for running in and out, Recoil Brake (Table II., Figs. *a*, *b*, *c*, *d*).—The trunnions of the 42-centimetre gun rest in light slides working on horizontal planes, the recoil being controlled by two hydraulic recoil presses, the piston rods of which are attached to the trunnion slides; the presses are fixed to an extension of the planes on which the slides work, which permits of a symmetrical arrangement of the weights, but entails, however, an unequal effect on the recoil presses, as it varies with every change in the elevation of the gun at discharge. The recoil cylinders also serve to run the gun in and out, the arrangements and mechanism for this purpose being as follows:—The recoil cylinders *E E'* (Table II., Figs. *a* to *d*) have at their after ends valve casings containing five valves loaded with Belleville springs, and under each cylinder is a small reservoir, into which the water flows on recoil; the forward cylinder supply openings are in *be* and *b'e*, the after ones in *ce*, *c'e*. Each piston has a pass valve loaded with a spring, which allows the water to pass from one cylinder space to the other, and prevents the formation of a vacuum. These valve-springs are very weak, and of brass, so that on the gun trials of the "Indomptable" they lost their elasticity after fifteen rounds, and the valves being off their seats, the gun was run out with difficulty. The method of securing the piston rods is peculiar, as they run through the whole length of the slides, and are secured by nuts. When the gun is in the loading position, the piston rods are run out their whole length, and, in order to protect them from injury, a semi-circular shield plate is fitted, 90 millimetres thick at the after end of the slide *he h'e* (Fig. *b*). At the forward end of the slide two buffers *fe* and *f'e* are fitted, formed of wood and indiarubber. The distribution slide *Te*, together with the slide valve of the elevating gear, forms a double valve, the details of which are shown in Fig. 7. The pressure is supplied through t_1 t_2 in the valve casing, and is led from these to the recoil cylinders by the pipes *te* and *t'e*; it can be seen by the lead of the pipes that in every case the pressure enters the forward cylinder spaces, and therefore in running out and in, the difference of pressure due to the difference of the areas of the two sides of the piston only, comes into action. The operation is effected by two levers, one of which is worked direct, and the other by a hand-wheel; the result is the same in each case, as both are fitted to a common shaft. If the hand-wheel is worked the lever slides in a recess of the platform, and shows the position of the slide by means of a graduated index and pointer; at its upper end this lever carries a projection *ie* (Fig. *b*), which serves for working or securing the platform bolt. In addition to this there is also a safety chain r_1 secured to it, and kept constantly extended by the weight K_2, the other end of the chain is secured to the revolving arm o_1 o_2 fitted to the sides of the gun support; the forked end *i* of this arm embraces a bolt o_3 of the protecting plate, so that the lever is depressed by this bolt before the slide has reached the buffers when running out. By this automatic

Fig. 6.

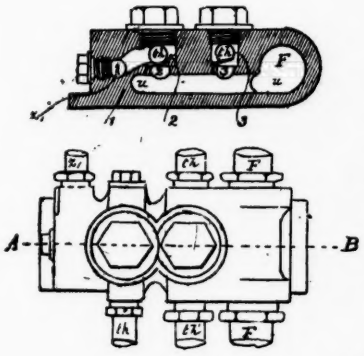


Fig. 5

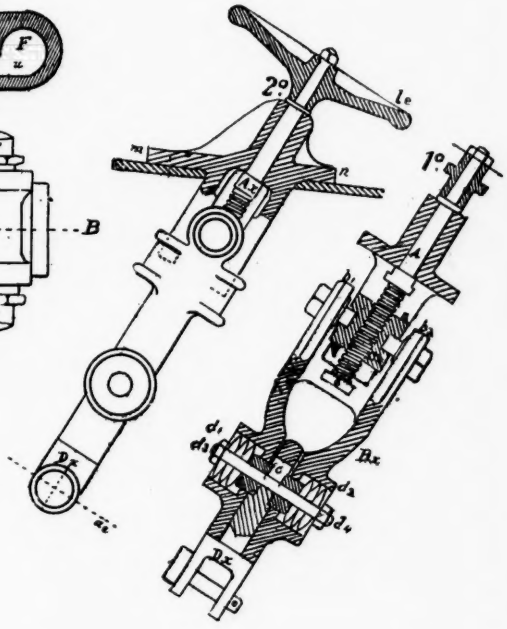
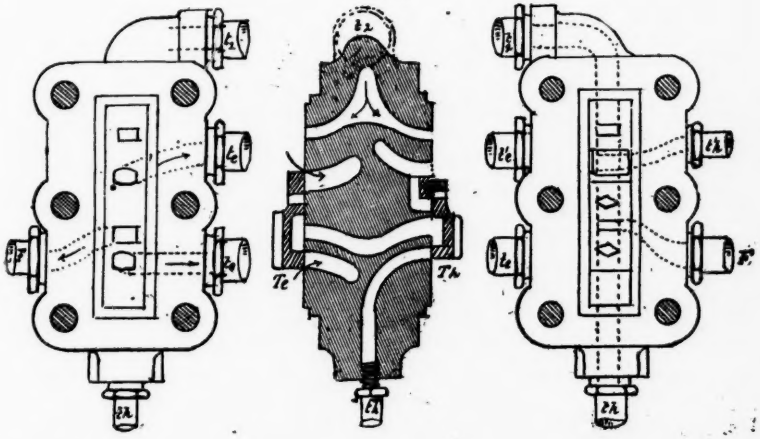


Fig. 7.



checking arrangement the running-out slide valve is also shut off at the right time, and the gun is brought up gently against the buffers. In connection with this check arrangement is the carefully-constructed hand-wheel shown in Fig. 5.

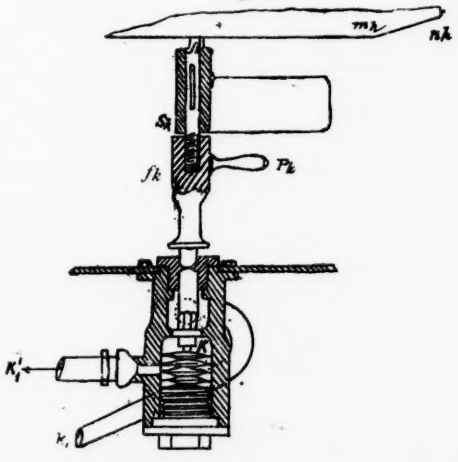
The spindle *Ax*, on which the hand-wheel *le* is keyed, has at its lower end a square thread screw carrying the nut *Cx* which works in straight guides formed in the bronze bracket *mn*. On this nut the bridle *Bx* is secured by the trunnions b_1 b_2; the lower end of the bridle carries the guide block *Dx*, by means of which the slide valve rod is indirectly connected to the hand-wheel. The block *Dx* is not fixed to the bridle, but held simply by the friction set up by six pairs of Belleville springs, so that when the water supply is automatically cut off by the above-mentioned apparatus when running out, the valve shaft *ae* is also depressed, causing a lengthening of the rod which is limited by the stop bolts d_3, d_4. The return or exhaust of the double valve is led through *F F'*, Fig. 6, and through the central pivot.

A very important addition to the above apparatus for the recoil is the snifting valve *Z* (Reniflard), the construction of which is shown in Fig. 6; it is in connection with the pressure supply and return, and with the elevating cylinder; the water coming direct from the central pivot enters at z_1, the return from the slide valve at *F*, and led further by *F'*; the water pressure of the elevating mechanism enters at *th*, and escapes again by *t'h* and *th*, of which *t'h* leads to the elevating cylinder and *th* back to the compound valve. The snifting valve casing was introduced subsequently to the preliminary gun trials, as it was found that, although the 42-centimetre gun was perfectly balanced on its trunnions, at the moment of discharge a considerable downward kick was perceptible, which set up a dangerous vibration of the whole system. In order to remedy this defect the valve casing is divided into two parts by a horizontal partition, and the upper part further divided into three parts—1, 2, 3, Fig. 6. In each of these spaces is fitted a clack valve of thin copper; the valve 1 is kept to its seating by the pressure supply entering through z_1. The valve in the space 2 is kept to its seating by the water pressure led through the snifting valve to the upper part of the elevation cylinder, from the slide valve of the elevating arrangement through the pipe *th* opening into this space. Finally, the water pressure pipe for the lower part of the "elevation" cylinder opens into the space 3 and presses valve 3 on to its seat. When the projectile leaves the mouth of the gun and the downward blow at the breech end is produced, a considerable increase of pressure is caused in the pipe *th* leading to the upper space of elevation cylinder, and also in space 2 of the snifting valve; at the same time a vacuum is produced under the piston of the elevation cylinder, which is also transmitted to space 3 and lifts the valve in this space so that the return water through *F F'* can now pass through space 3 under the piston of the elevation cylinder, destroying the vacuum found there by filling the space with water, and so rendering any further vibration of the system impossible. The excess pressure in the upper cylinder space can open the valve 1 and allow a portion of the water

to escape into the main supply pipe, so that there is no danger that the slide valve may be forced off its seating by the excess pressure. This valve arrangement also serves to fix the gun during the discharge and to protect the distribution slide against an excess of pressure.

The Elevating Arrangements (Table II., Figs. *a*, *b*, *c*, and *d*).—This arrangement is good in construction, in so far that only the gun itself has to be lifted, resulting in a considerable saving in weight as compared with that in which the slide and mounting has to be lifted as well. The gun rests with its trunnions in the slide, and is connected by the band *z* to a beam *Lh*, working on the pivot bolt or hinge h_1. In the central plane of the gun a small sliding block *S* is fitted on the beam *Lh* connected to the band *z*, so that it may adjust itself on the beam to suit the movements of the gun in running in and out and during recoil. It follows also that during these movements the elevation of the gun does not remain constant, but varies according to the position of the beam *Lh* at the time. The horizontal position of the beam is fixed by the bearer h_2 secured to the platform, and in this position also the beam lies on the bar *Ga* (Table I., Fig. *a*), allowing the platform bolt to enter a recess in the rod, and so making any further movement of the elevating arrangement impossible. The movements of the elevating beam are effected by the elevation cylinder *H*, the supply pipes *th*, *t'h* of which have been partly described, and, as indicated, the slide valve forms with that for the running-in-and-out arrangements a double valve (Fig. 7), and is worked by the hand lever *lh* (Table II., Fig. *c*) on the left of the gun. In this case also there is an index and pointer graduated between the extreme positions. The lever is so fitted to the platform that when in the extreme position for "elevate" the projection *ih* comes against the bolt *J*. A safety valve for the discharge, *K* (Fig. *c*, Table II., and Fig. 8), must be introduced into the elevating mechanism for the

Fig. 8.



following reasons. When the gun is laid horizontally, the elevating beam Lh makes an angle of 5° with the axis of the gun, so that the breech end is lifted a considerable amount during the recoil, and when fired with depression to such an extent that the chase comes into contact with the edge of the turn table, rendering firing at short ranges impossible. A branch pipe K_1 is fitted in the pressure pipe leading from the snifting valve (Reniflard) to the lower part of the elevation cylinder, which communicates with the lower end of the safety valve, and is connected with an air chamber X through the pipe K'_1. The object of the latter is to take up the blow, and is in communication with the return water main by the pipe K (Fig. c). The valve K, loaded with Belleville springs, separates the two communication pipes K_1 and K''_1. At the upper end of the valve spindle is an inclined plane, which is in contact with the gun slide, and the spindle can be lengthened or shortened as necessary. As soon as the recoil commences the valve is opened slightly and puts K_1 and K''_1 in communication with each other, and also with the lower end of the elevation cylinder, permitting a slight escape of water from this cylinder, which allows the gun to sink by its own weight, so that at the end of the recoil it has very nearly the same inclination as before discharge.

In carrying out some trials with the gun it was remarked that, in running in, there occurred a tolerably heavy blow just at the instant the gun was run in, and to avoid this the valve spindle was shortened so that the inclined end no longer remained in contact with the slide; this made the opening of the valve K impossible, and prevented the too sudden emptying of the elevation cylinder. Before the completion of the running-in movement, care must be taken that the gun is lowered so that the head b of the breech opening shaft Av (Fig. 4) is geared with the fork on the gun platform, so that there is no obstacle in the way of opening the breech. After this alteration, the "Reniflard" valve became superfluous, as there was now no necessity to hold the gun in a fixed position by the pressure supply; but rather to allow the breech of the gun to sink slowly by emptying the elevation cylinder through the safety valve; oscillations of pressure in the supply pipes being avoided by the air chamber.

The ships of the "Neptune" class, "Neptune," "Marceau," and "Magenta," are supplied with four 34-centimetre barbette guns, one of which, as bow chaser, is protected, the others unprotected, also with thirty-three quick-firers and eight mitrailleuses; they are armoured throughout at the water-line, the armour being brought lower down forward to strengthen the bow. The hydraulic fittings of these ships are the same as in the Spanish battle-ship "Pelayo," viz., a Canet installation, with some alterations by Lagane, directeur des Chantiers de la Seine. The platform is fixed to a strong central-pivot tube, which extends down to the magazine and serves for the ammunition hoist. For the service of the four barbettes three pumps are fitted, one for the forward, one for the after, and a more powerful one for the two central barbettes. The two former pumps supply at a steam-pressure of 4 atmospheres (60 lbs.), and 60 revolutions per minute, 300 litres (66 gallons) of water at 80 kilo-

grammes per centimetre^2 (1,130 lbs. per square inch), while under the same conditions the larger pump supplies double this amount (600 litres per minute).

Training Gear (Figs. 9 and 10).—In this case the training is not effected by two chains wound on a drum, but by a pitch chain, the two ends of which are secured to the two presses *A*, the chain itself passing over the toothed wheels of the pistons *E*, and around the toothed collar secured to the central-pivot tube *P*; the presses are sufficiently powerful to train the forward and after barbettes, through 127° on either broadside in 56 seconds, and the two central barbettes 90° in 40 seconds. The details of the training arrangement are the following:—The distributing valve *Th* (Fig. 10) is situated under the directing positions, and is worked by the hand-wheel v_1 on the upper end of the training spindle *V*, which is supported in bearings at *A* and *B*, and is fitted with another auxiliary hand training wheel v'_1 at the lower end, the shaft of which has a bearing at *E'* and rests in the socket *D*. The spindle is screwed at two parts of its length, the upper part, with a screw of 20-millimetre pitch, having at each end of it, at the limits *b'* and b'_1, stop nuts to prevent the spindle revolving any further, and the lower part with a screw *V''* of 55-millimetre pitch for the reception of the toothed wheel V'_1. The latter wheel gears into the cog-wheel *R*, and performs the function of a lever for working the slide, by means of a collar which is in connection with the valve rod. The centring wheel *R* gears also into the small wheel *R'* and so revolves the pinion G_1 which gears into the collar *H* fixed to the ship's plating *Q'*. The mode of action is as follows:—When the gun is in the position of rest the nut *b* is equidistant from *b'* and b'_1, and the slide valve is in its central position. When the hand training wheel v_1 is worked in the direction required for training, the cog-wheel nut V'_1 is raised or lowered, its teeth, however, being sufficiently broad to remain in gear with *R*, and by its movement works the slide valve, putting one cylinder in communication with the pressure supply, the other with the exhaust. The movable platform now commences to revolve, when the pinion *G* is worked by the toothed collar *H*, so causing the wheels *R* and V'_1 to revolve, and bringing the latter, and consequently the slide valve, back again to the central position; these movements will continue so long as the hand training wheel is worked, and should the stop nut *b* reach either of the limits *b'* or b'_1 in continuing the training, the spindle *V* is stopped and the slide valve automatically shut off.

Loading Arrangements.—As already mentioned, the central pivot tube is sufficiently large to serve for the passage of the ammunition up to the rear of the gun, and, from a tactical point of view, this arrangement is considered to be a necessary one. All hydraulic mountings of modern ships are on this system, which permits of the gun being loaded in any position of the platform, and considerably increases the rapidity of fire. In order to still further increase this rapidity of fire the ammunition carriage has been modified, so that instead of having to use the hydraulic lifting presses for three or four positions of the carriage, one fixed position

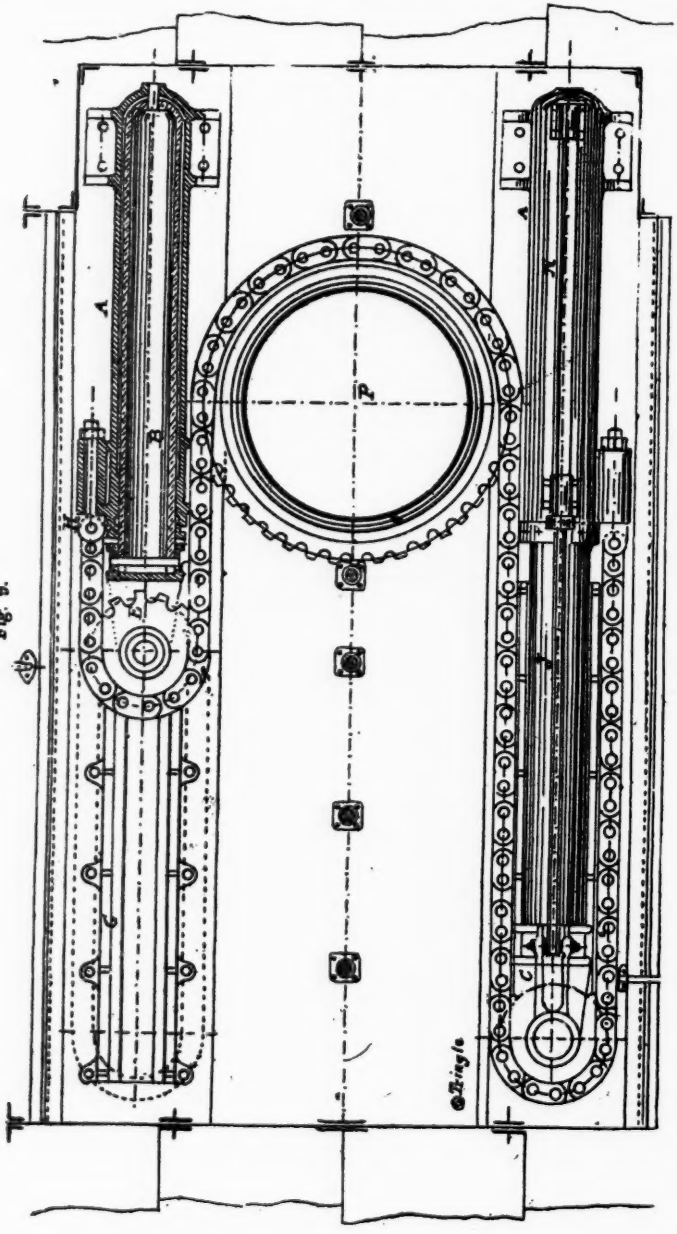


Fig. 9.

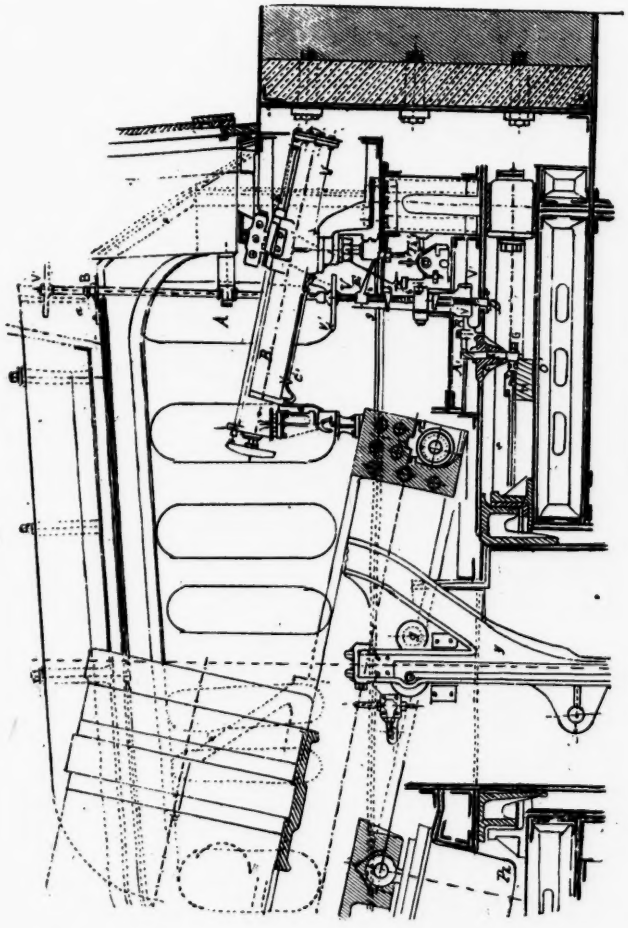


Fig. 10.

only is used, and a revolving carriage employed for the projectile and two half-cartridges. By this arrangement also the space in the central tube is used to the best advantage (see Figs. 1, 2, 3, 4, and 7, Table III.).

This carriage comprises the platform *D*, the trolley *d*, and the revolving ammunition holder *R*. The upper side of the platform is fitted with rails for the horizontal movements of the holder, and a solid crossbar *Z* is fitted underneath, its ends being secured to the ends of the pitch-chain from the lifting presses. The carriage travels on guides *y* on the inner plating of the central pivot tube *P*, which revolves with the gun-platform. In order to hold the carriage in its lowest position for the reception of the charge, a holding ring *s* and stopper is fitted below it. The trolley *d* rests on light rollers *e*, and embraces the ammunition holder *R* with the two bands *d' d'*. At the sides four guide-rollers are fitted, the larger ones *f* for lowering, and the smaller *g* for hoisting and guiding the holder at the latter part of its ascent, so that it avoids the breech and is brought to rest directly in rear and in line with it. The revolving holder has the three lined tubes, *r r' r''*, for the reception of the ammunition, and is placed in the required position by the help of a handle and the cog-wheels 1, 2, 3, 4, and 5, a simple catch arrangement sufficing to hold it in the three necessary positions. In the magazine, a circular railway *O* around the pivot tube serves for filling the holder in any position of the platform. The projectile is laid on the loading-table *T*, and held by a stopper apparatus preparatory to loading; originally it was held by an automatic catch worked by the carriage, as shown by the counter-balance 6'' and the rods 6 and 6', but this was soon abandoned, and the arrangements 7 and 7' introduced, which is freed by the pawl 8. For hoisting the charge, the two presses *Pm*, secured inside the pivot tube, are employed; these also are inverted block purchases, so arranged that the pistons travel downwards for hoisting, this being the most favourable position for taking the strain. At the upper end of the piston rod the chain 10 is secured, and is led upwards over the roller 11, then downwards by *y* over the roller of the piston rod 10, and again up over the roller 12, and finally down to the ammunition carriage, where the other end is secured. The axis of the roller 12 is somewhat lengthened outwards, and serves for opening the ammunition tube, which is closed by a horizontal sliding door resting on rollers; the arrangements are so simple that no further explanation is necessary. This door is fitted with a projection, which takes in a recess in the shaft of the breech-working arrangement, and renders any movement of the breech impossible while the ammunition hoist is open; the shaft of the breech gear is only freed when the ammunition carriage, in descending, has completely closed the sliding door of the tube.

Two automatic brakes, or check valves (Fig. 7, Table III.), are fitted to the supply pipes of the ammunition presses, to prevent the too rapid travel of the carriage when nearing the ends of its travel. They consist of simple piston valves, the spindles of which project through stuffing boxes and carry rollers; two grooves are cut in the platform of the ammunition carriage in slanting directions, *u* for the hoisting and *u'* for the lowering

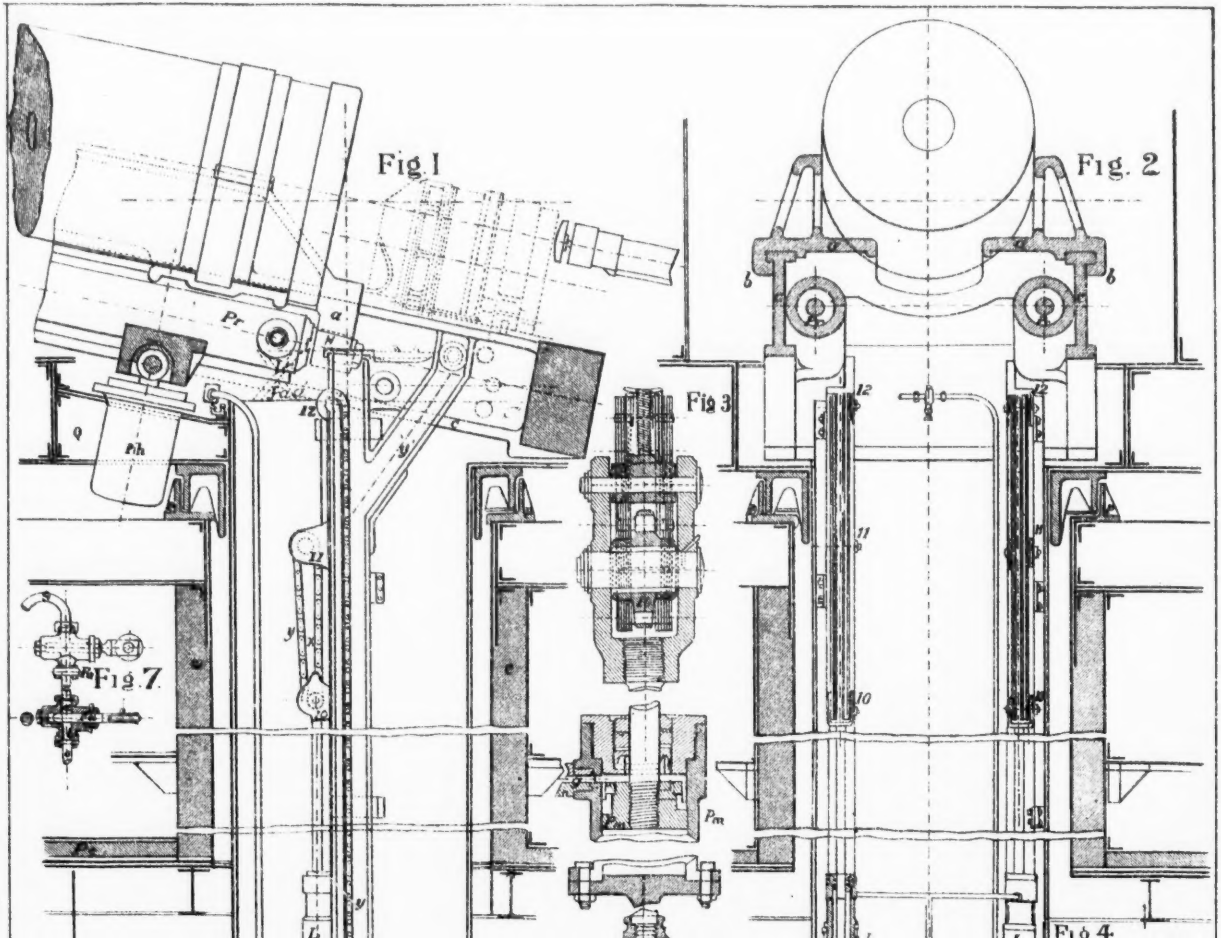


Fig. 1
Fig. 2
Fig. 3
Fig. 4
Fig. 7
Pr
Fed
Ph
Pm
a
b
y
10
11
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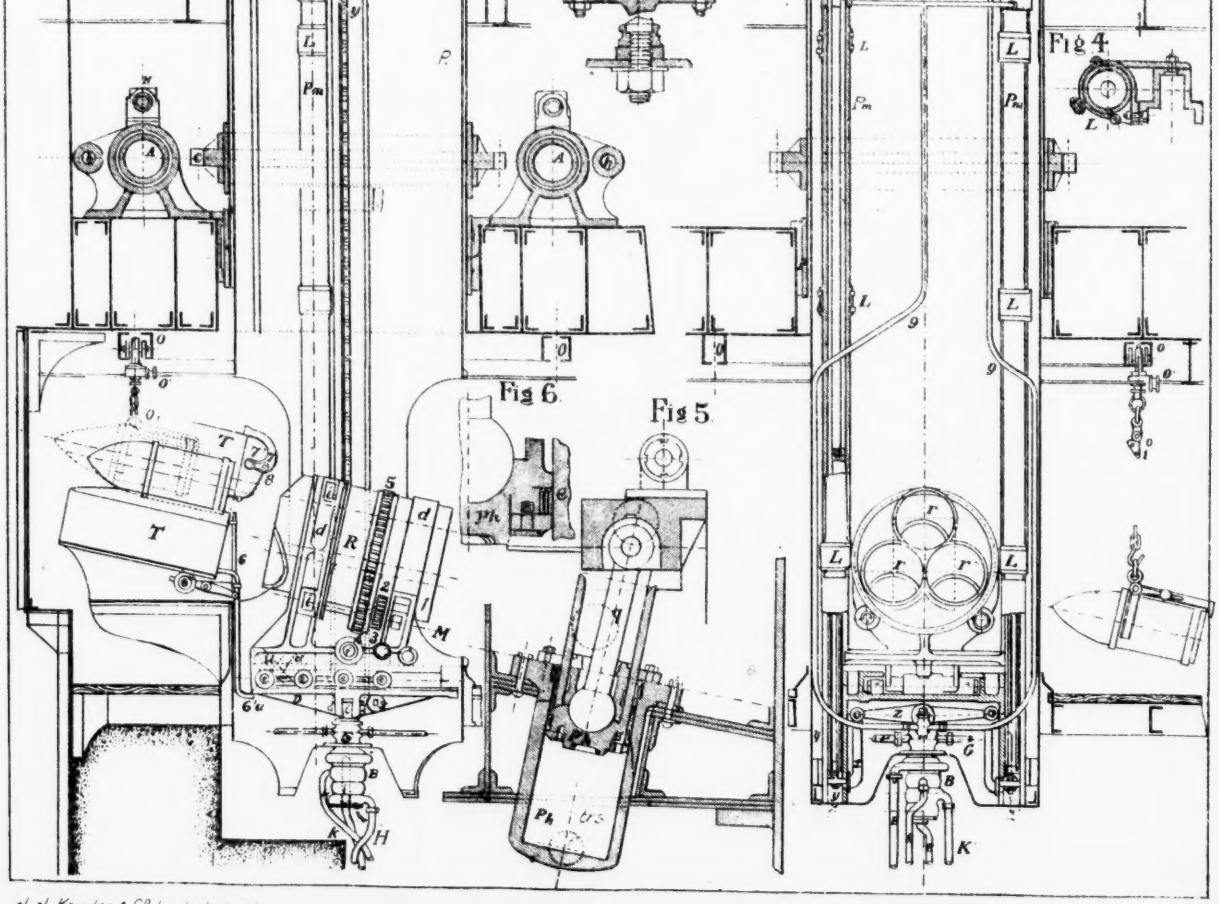
Fig 4
Fig 5
Fig 6
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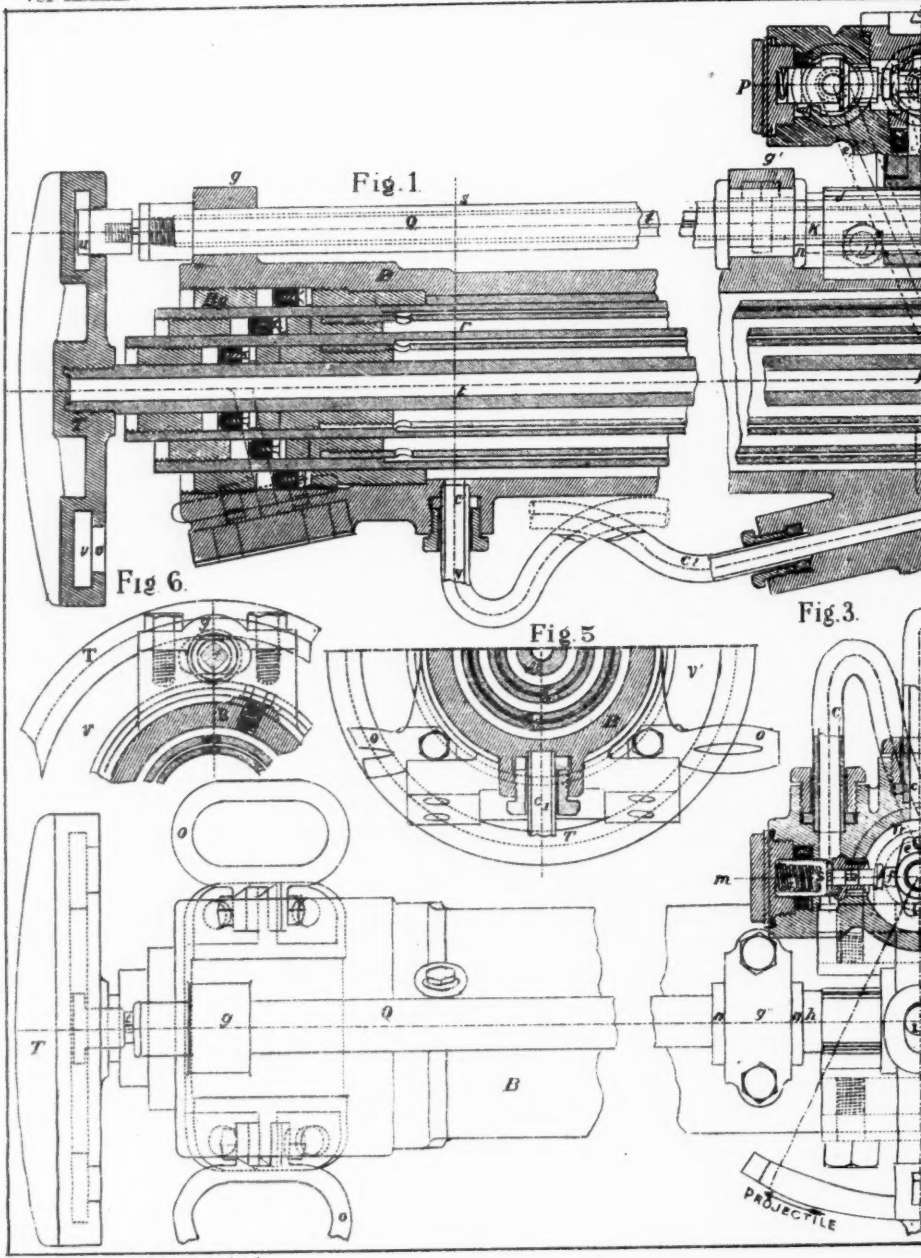
TABLE



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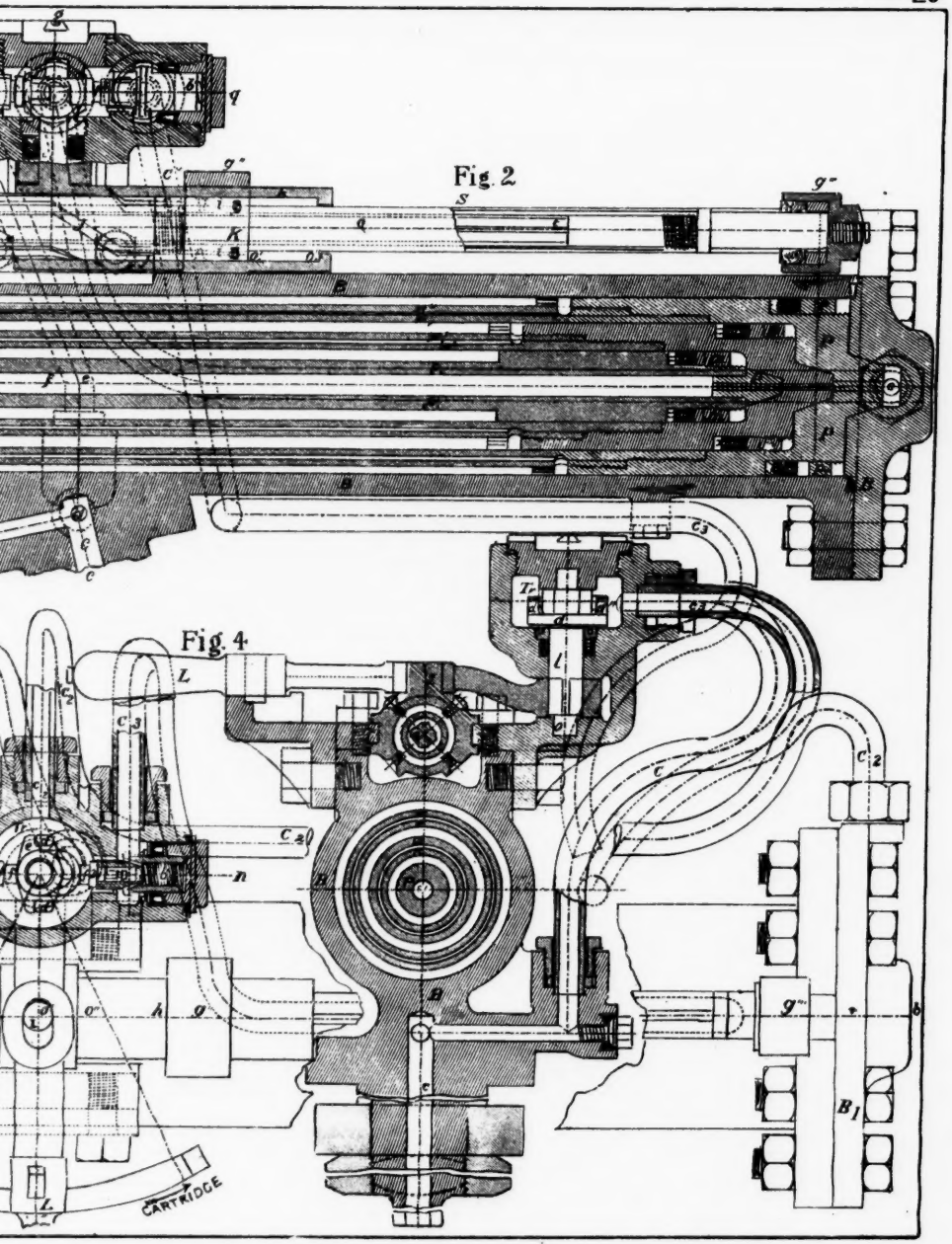
Fig. 2
Fig. 4
CARTRIDGE

directions, and by this simple arrangement the water supply is throttled without the necessity of working the slide valve lever. The upward movement of the carriage is limited by its contact with the screw *v*, which causes two stop bolts to gear in *s'* and fixes the position of the carriage; when the hand lever is placed in the return position these stoppers are placed out of gear. The hydraulic rammer (see Table IV.) is worthy of notice, inasmuch as it is arranged to swing around a central support, and is fitted with an automatic "cut off" arrangement for loading the cartridges. At the first view its construction appears very complicated, but for the work required of it this is not the case, as the following description will show :—

The outer shell of the rammer is formed of the bronze cylinder *B*, the after end of which is closed by the cover *B'*, and to this cover is connected the pipe c_2, the supply and return pipe to the slide valve *Tr*; the joint between cylinder and cover is made watertight by a copper ring, and inside the cylinder are the three pistons, *p p' p''*, forming the telescopic rammer. The inner (smaller) piston is formed of the phosphor bronze tube *p*, fitted at the lower end with a packing leather and at the upper end with the rammer head *T*, screwed on, and covered with wood on its outer surface. The next following (intermediate) piston *p'* is formed of two phosphor bronze cylinders *m'* and m'_1, screwed one over the other, leaving a small space between them, for water circulation, in communication with the other spaces of the rammer by connecting channels at the ends. The third and largest piston *p''* is similar in construction and is formed of the phosphor bronze cylinders *m''* and m_1''. The tube c_1, from the slide *Tr* at the forward end, is a pressure supply pipe only, while c_2 serves both for supply and exhaust; the pressure is led to the valve casing by the pipe *c*, and to the return water tank by the pipe c_3. The slide valve generally used is not employed here, the water distribution being effected by the two spring-loaded valves *s* and *s'*, the former for the pressure and the latter for the exhaust service; both are enclosed in one casing, which we shall call the "distribution valve" casing. The outer parts of these valves form hollow cylinders *b b'*, for the reception of the springs by which the valves are kept constantly pressed against their respective seats; the body of each valve is pierced with a small hole in order to prevent abnormal pressure in the spaces *b b'*. These valves are worked by means of the hand lever *L*, which is fitted on the square of the short axle *l* working in the bearing *o*. This axle carries at its outer end the plate *d*, on which are the two projecting pins *d' d''*, which gear in the recesses of a distributing plate *e*, the two other sides of which form the small pistons *f f* bearing against the lower ends of the valve spindles. In an elongated eye of the hand lever is geared the pin *o'* of a sliding block *K*, the object of which will be explained further on. In the sketch the lever *L* is in its middle position, the pressure valve *s* closed and the exhaust valve *s'* open; and, consequently, the return water from the cylinder *B* passes through the valve casing on to the water tank. It will be observed that the pins *d'* and *d''* always move the distributing plate *e* in the same direction, that is, from right to left, whether the lever be

placed at "projectile" or "cartridge," as the plate only has lugs on one side for the pins d' d'' to take against, consequently the pressure valve s is opened in both cases, and s' closed by its spring as soon as the small piston f is withdrawn. The water supply at constant pressure from the pressure pipe c_1 therefore flows through the pressure valve s into the pipe c_2 to the after end of the rammer and pushes it forward; the pressure at the after side or larger surface of the rammer being in excess of the constant pressure at the forward or smaller surface. If the lever is now placed in its middle position the pressure valve s is closed and exhaust valve s' opened, and the pressure at the forward side of the rammer comes into play and pushes out the three rammer pistons p p' p'' from the cylinder B. The rammer turns on a pivot at the middle of its length, and is moved to the required position by means of the handles O, which also serve for securing it.

Above the rammer cylinder is the automatic stopping arrangement S, the rods of which pass through the supports g, g', and g''; g' is also the limiting block. The apparatus consists of the four steel parts h, K, Q, and t; the cylinder h (in two parts) carries the pin 1, which fits in the elongated eye of the hand lever; the cylinder itself is movable in the direction of its length through the bearing g'', but is not free to revolve, and is fitted with four screws i, the inner ends of which enter grooves cut in the inner cylinder K; this cylinder is free to revolve but cannot move in the direction of its length, as it is fixed against the bearing g' by the flanges n. The grooves in this inner cylinder run at first parallel to the axis, then for about a quarter of a turn in a spiral direction, and then again parallel to the axis; the revolution of the cylinder K causes the shell Q to revolve, and with it the square shaft t fitted through it, and which has at its forward end an elliptical head u, the smaller axis of which passes through an opening v' in the rammer head T, and when inside this opening v has sufficient room for its major axis in any direction. When these parts are in the position as shown in Fig. 1, the rammer can be pushed forward without taking the rod t with it, as the elliptical head u can pass freely through the opening v'; but as soon as the rod t makes a quarter of a revolution the head u cannot pass, and the rammer head carries the rod t with it.

The action of the rammer is as follows:—When the hand lever is placed at the position marked "projectile," the pressure valve s is opened, the exhaust valve s' shut, and the rammer goes forward without taking the rod t with it, for during the movement of the hand lever the casing is moved along by means of the pin 1, and the screws i slide in that part of the grooves which is parallel to the axis, so that the shaft t is not revolved and its head passes freely out of the rammer head T; the rammer completes its full stroke and sets the projectile "home." If the lever L is now brought back to its middle position the rammer returns as the pressure-valve s is shut and the exhaust s' opened. When the lever is placed at the position marked "cartridge" for loading the first half, the valve s is opened and s' shut, the cylinder h is moved along and in such a position that the screws i slide in the spiral part of the grooves and so

TABLE V

Fig.1

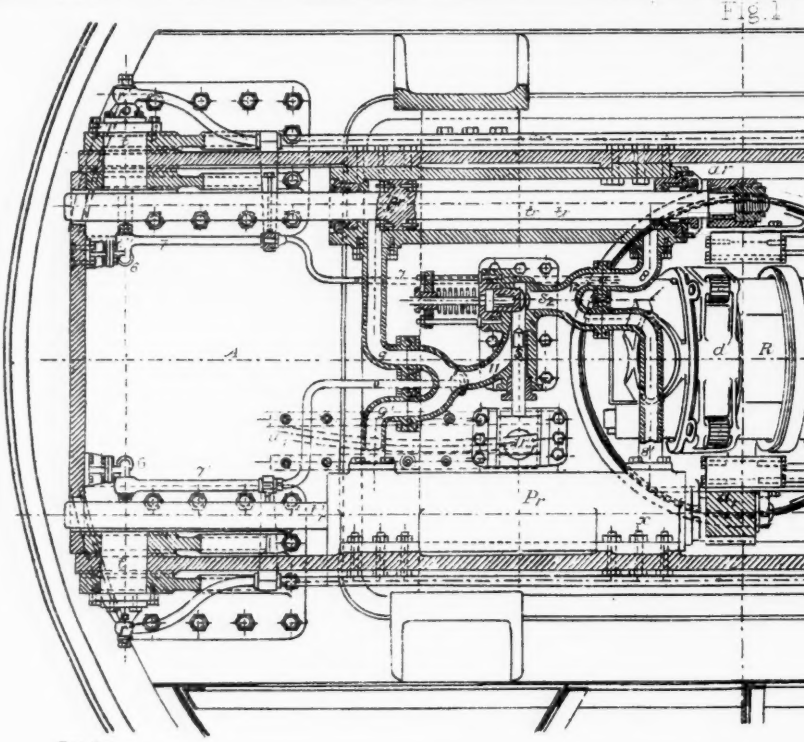

Fig.3

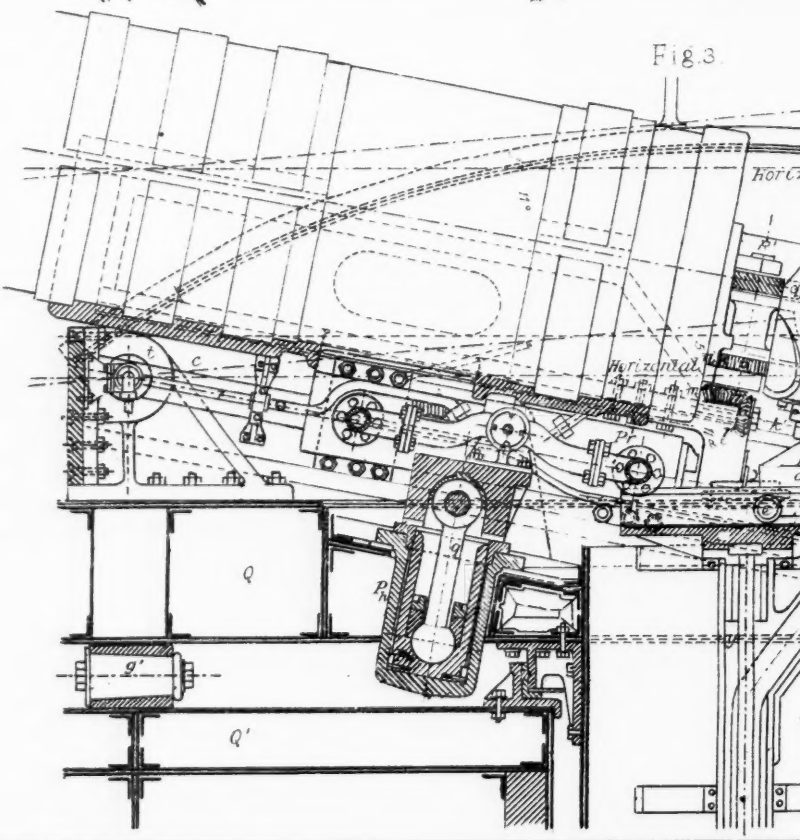

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Fig.1

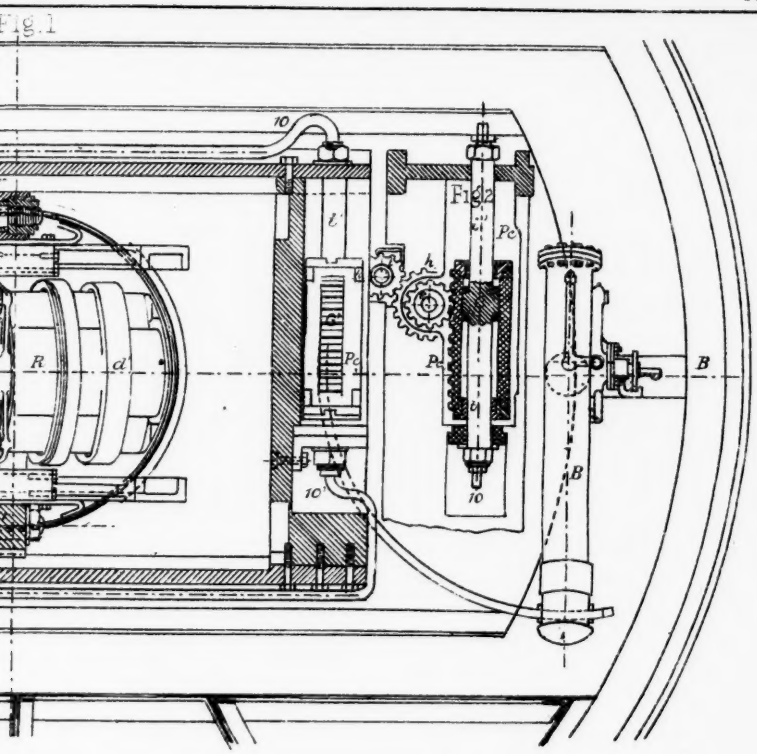
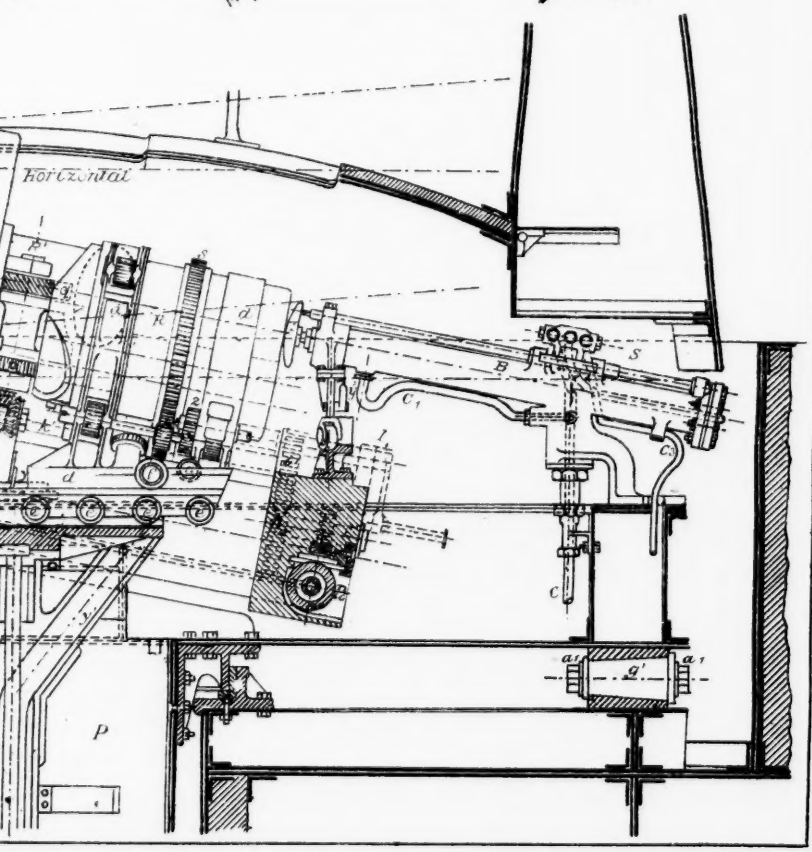


Fig.2



cause the shaft *t* to revolve, coupling it to the rammer head *T*, which carries the shaft with it, and the head g''' at the after end approaches the cylinder *h*. As soon as the first half-cartridge has nearly reached the position required for the reception of the second half, the head g''' comes into contact with o_1'' of the cylinder *h* and carries this cylinder forward till its after end o_1'' arrives at o_1'. The distance o_1'' o_1' equals o' o'', so that the lever *L* is brought back automatically to the return position, the return movement of the rammer follows, and at the same time the shaft *t* is revolved back to its original position, so that all the parts are again in position as at starting. The second half-cartridge is loaded in a similar manner, during which operation the first half is pushed forward to its proper position.

Breech-working Arrangement.—The breech of the 34-centimetre gun is the same as that already described for the 42-centimetre gun, but the opening and closing mechanism is different, being simpler and more effective; it is, therefore, shown on Table V., Figs. 1, 2, and 3, so that it may be described. The movement of the breech is effected by one hydraulic cylinder only, which, however, is double-acting, and consists of the horizontal cylinder *Pc* fitted at the rear of the gun. In the cylinder is a fixed piston, with a piston rod at each end of it, and the necessary pipes leading to the piston, which are so arranged that one pipe is under pressure while the other is open to exhaust. On the upper surface of the cylinder is the rack c_1, which gears with the pinion e' (on the spindle *f*). This pinion gears with the following wheels in succession, h' i'' j l' m' n' o', and the shafts k' p', so that the movement of the cylinder *Pc* is transmitted to the tooth wheel q', which opens and closes the breech in the manner already described in the 42-centimetre fittings.

The Running-in-and-out and Recoil Fittings (Figs. 1 and 2, Table V.).—The recoil presses *Pr*, placed at the sides underneath the gun, are employed for running in and out. The steel cylinders of the presses are secured to the gun slide by the bolts *x*, and are fitted with packing glands at both ends for the passage of the piston rods *tr*. The piston *pr* is solid with the rods, and fitted with double packing leathers, and the after ends of the rods are fixed to the carriage *ar*. For the forward ends of the cylinders are the supply pipes 9 and 9′, and for the after ends 8 and 8′, and both leads are connected by the branches 11 and 12, opening into the valve casing S_1 S_2. The pressure supply comes from the working slide, through the pipe 6 (Fig. 1), and from here through the pipe 7 into the connection 12 (after cylinder spaces) and through the other pipe 7′ into the connection 11 (forward cylinder spaces).

On the outer side of the trunnions are the bends r'' by which the water pressure passes through the trunnions, and is led by the pipes 10 and 10′ to the slide valve of the breech-working apparatus; the pipes 7 7′, and 10 10′ are so arranged that when 7 and 10 are pressure pipes 7′ and 10′ are exhaust, and *vice versâ*. In the valve casing S_1 S_2 are the two valves S_1 S_2, one of which, S_2, shuts off the communication between the pipes 11 and 12, and is kept on its seating by Belleville springs. The valve S_1 forms an integral part of the recoil brake, as it is so worked that

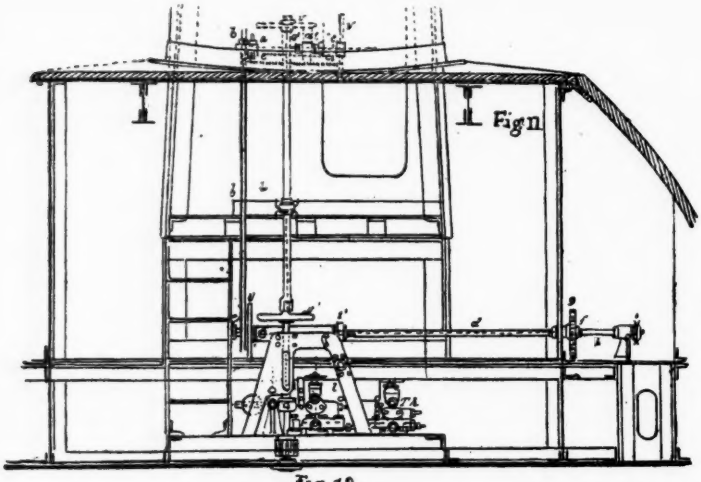
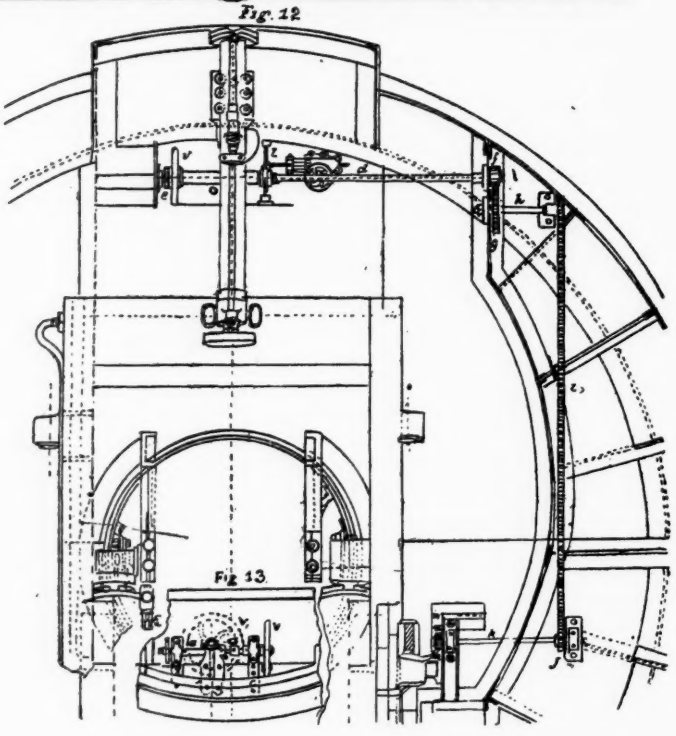


Fig. 12



the pressure in the recoil-presses during recoil is kept constant, which would not otherwise be the case, as the cylinders are not grooved and the piston works in them water-tightly. For this purpose the outer end of this valve spindle is fitted with a roller which runs in a curved path, so formed that the area of the valve opening is adjusted in proportion to the velocity of recoil.

The action of these valves is as follows :—If the gun is run out the valve S_1 is wide open and S_2 shut off; to run in, the distribution slide is so placed that the pressure supply can pass through the pipe 7′ into the branch 11, and from there through 9 and 9′ to the forward cylinder spaces, and at the same time the after cylinder spaces are placed in communication with the exhaust through the branch 12 and pipe 7; to run out the operation is reversed. When the gun is in the firing position the valve S_2 is closed and S_1 open, and the return water is forced through the valve casing to the forward cylinder spaces; at the end of the recoil the pressure in the pipes is only normal (the area of the passage being regulated by the valve S_1 as already mentioned), and the gun is afterwards automatically run out so that re-loading can at once be proceeded with.

The Elevating Gear (Table III., Figs. 1, 5, and 6, and Table V., Fig. 2).—This consists of the elevating cylinder *Ph*, on which works the trunk piston *ph*, the rod of which is connected to the piston and gun-slide by universal joints. The press has two supply openings, the upper one communicating constantly with the pressure supply and the lower alternately with the pressure and exhaust. The method of packing the piston is shown in detail in Table III., Fig. 6. The working parts of the elevating arrangement are sketched out in Figs. 11, 12, and 13. The hand-wheel *V*, at the controlling position, is connected with the horizontal shaft *a*, which carries a sprocket-wheel with the pitch chain *b*. This upper shaft *a* is screwed at one part of its length, on which is fitted the nut *a′* working in guides and limited by the stops *c′ c′* if the gunner should not shut the hand-wheel *v* at the right time; this also serves as brake and disconnecting gear for the extreme elevation and depression. There is also the shaft *d* provided with a screw and the nut *e*, which is in connection with the valve rod of the elevating valve. At the right-hand end of the shaft *d* is the toothed wheel *f*, worked by the pitch chain *i* and the wheel *g*, the latter being actuated by the curved rack on the gun-slide.

The action of the elevating gear is as follows :—When all the parts are in the position of rest and the slide in its middle position, the nut *a′* is equidistant from *c′ c′*. If the hand-wheel *v* is turned in the required direction for elevating, the nut *e* moves along the screw and opens the slide valve, allowing the water to escape from the lower part of the elevating cylinder *Ph*, and the after end of the gun drops. The curved rack *n* then causes the wheel *m* (and also by means of the pitch chain, the shaft *d*) to revolve, and the nut *e* can be brought back to its original position; that is, if the hand-wheel *v* is held fast, the screw of the shaft *d* comes into play, and brings back the nut to its original position, centres the slide valve, and the movement ceases.

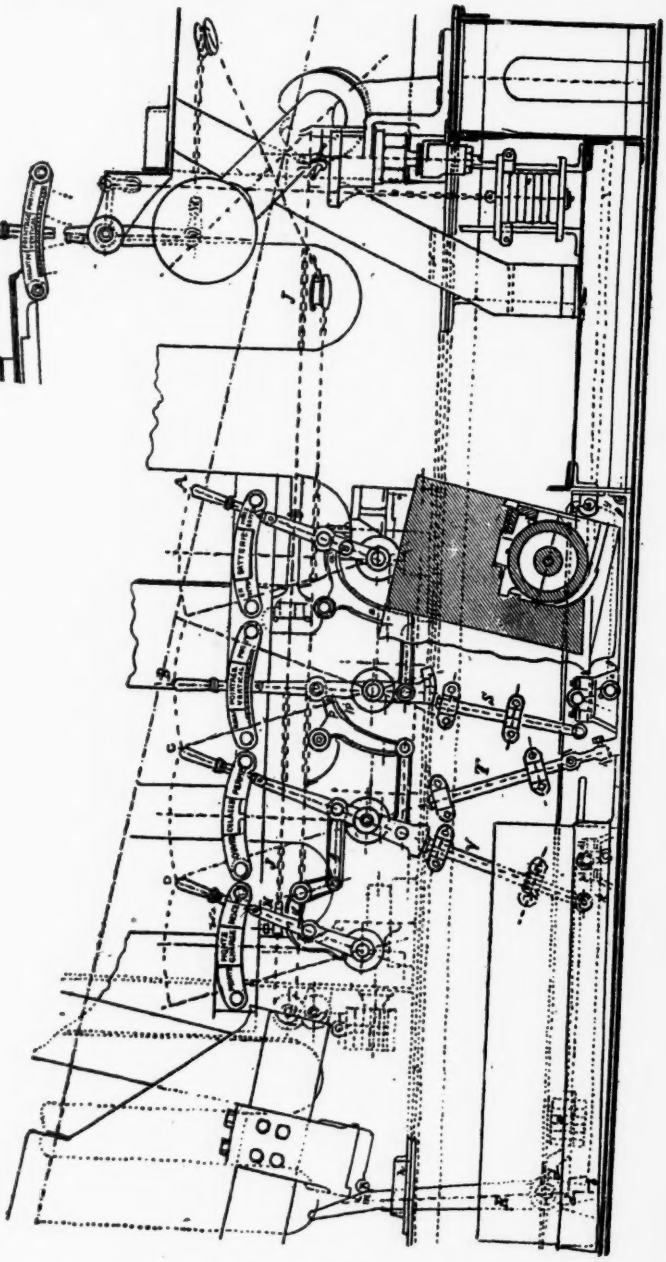
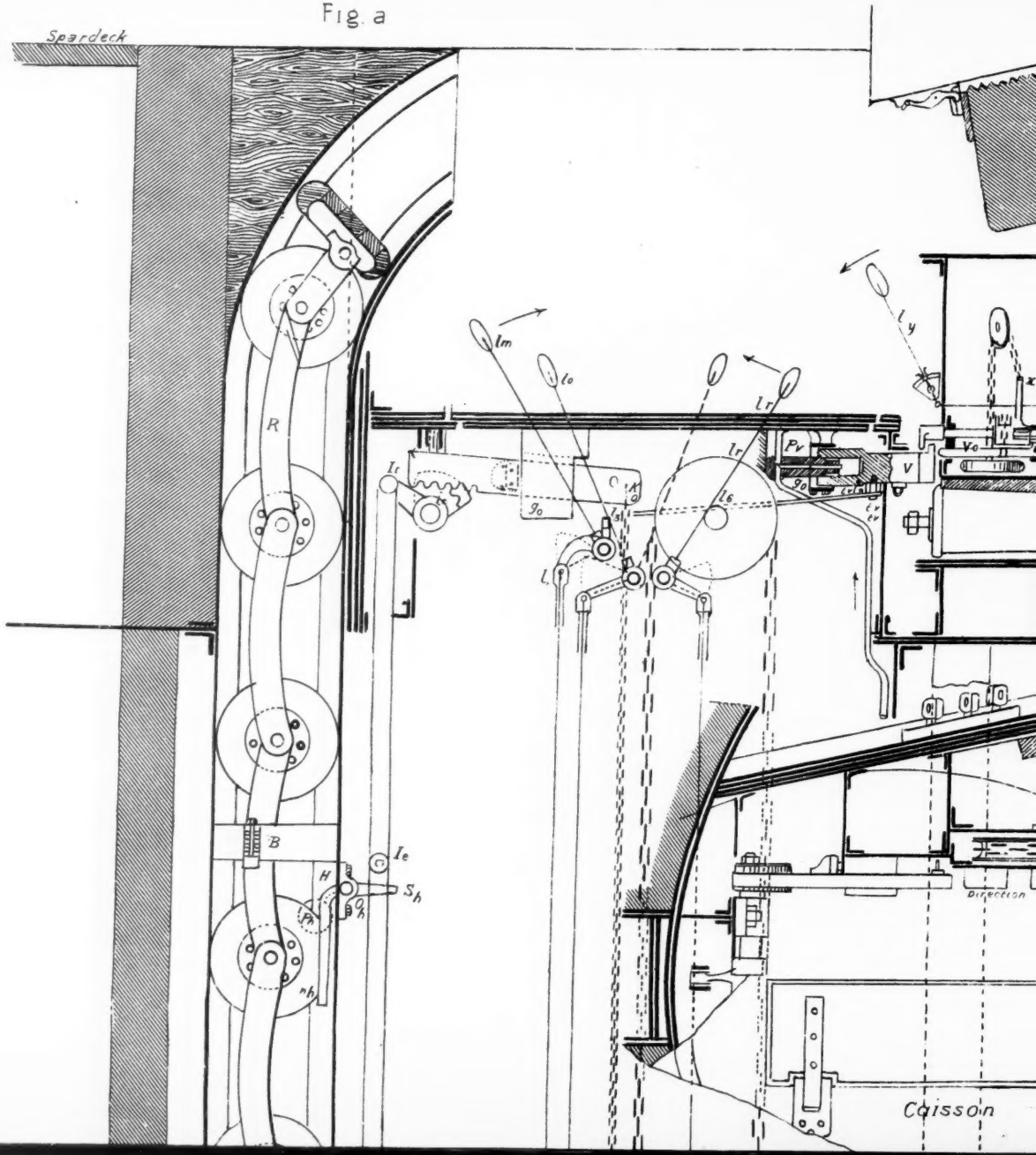


Fig. 14.

Longitudinal section.

Fig. a



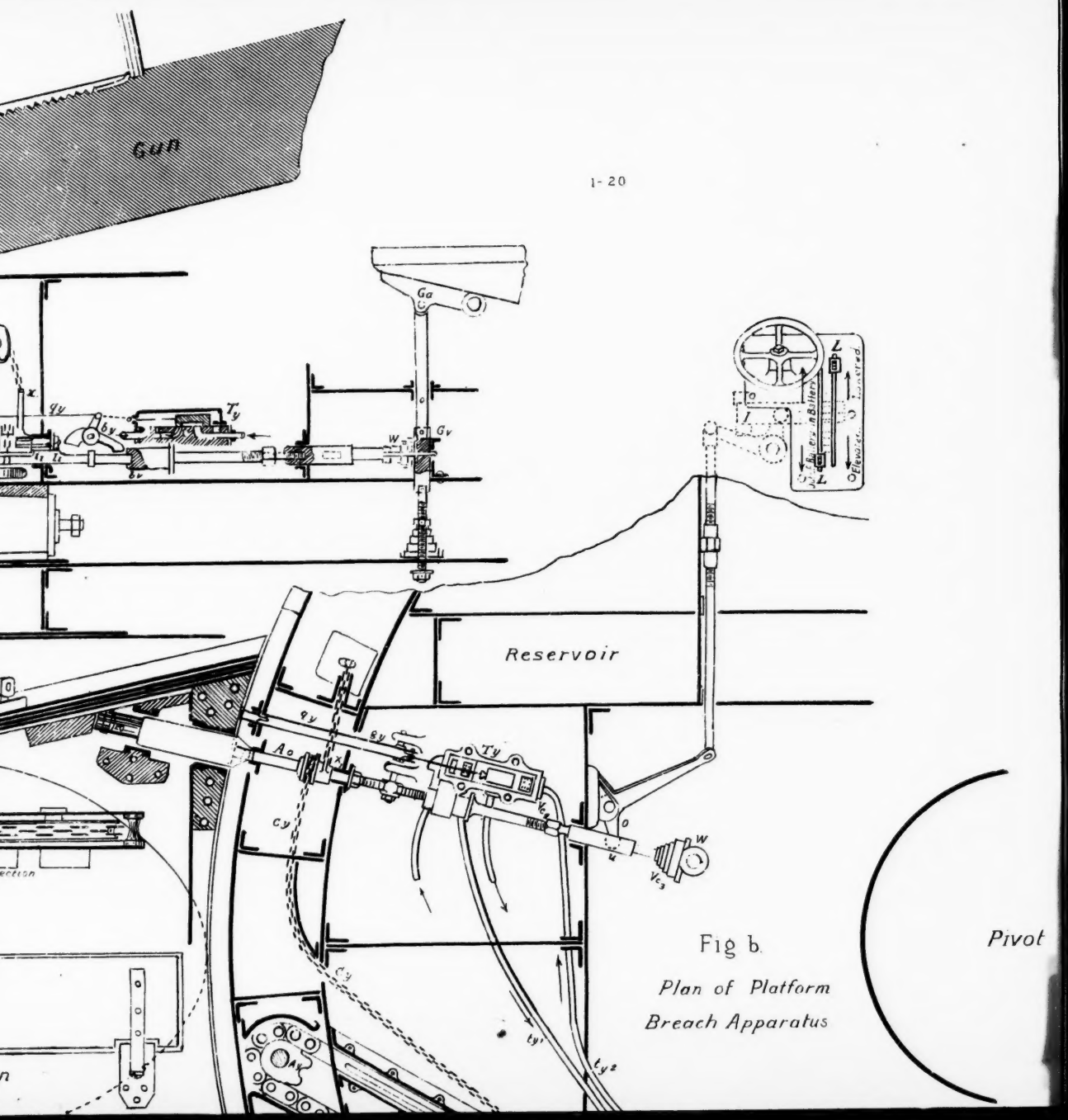
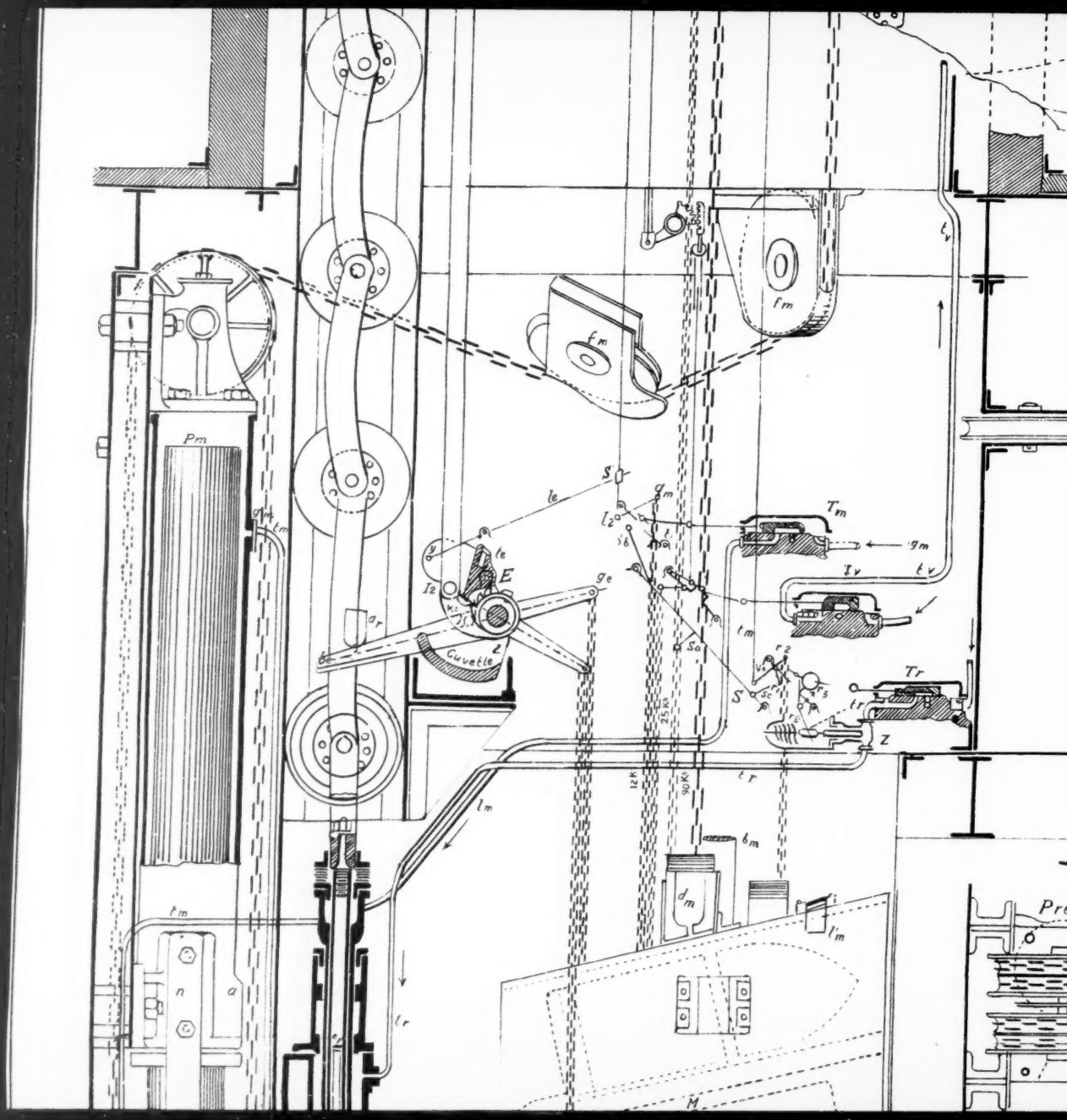


Fig b.

Plan of Platform Breach Apparatus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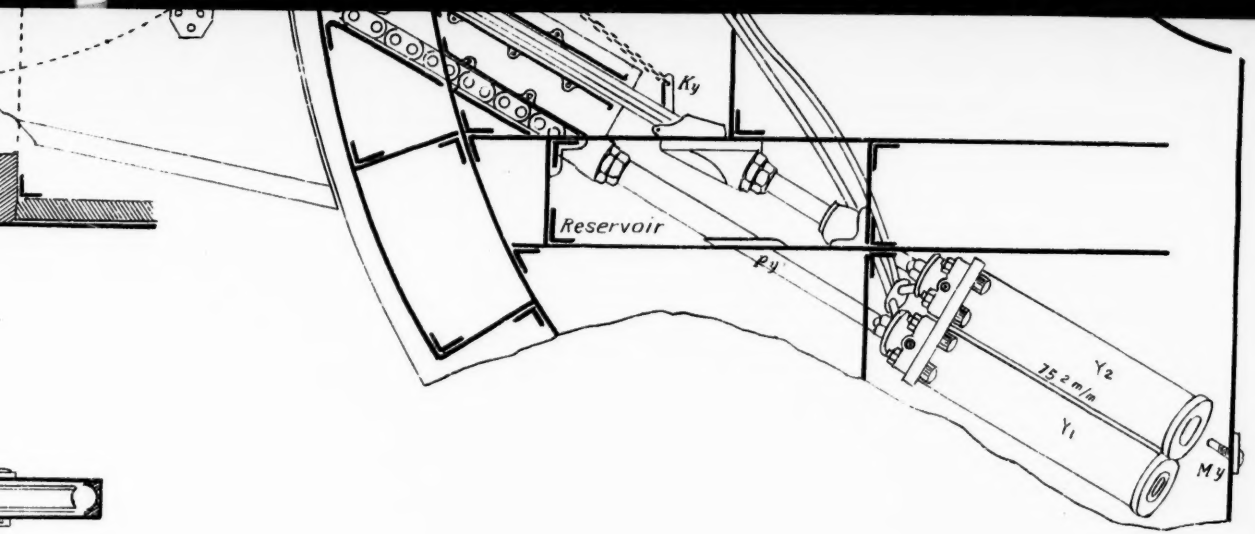
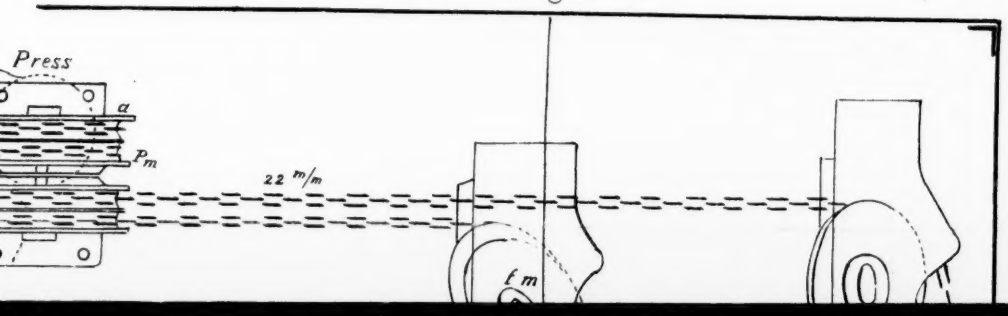
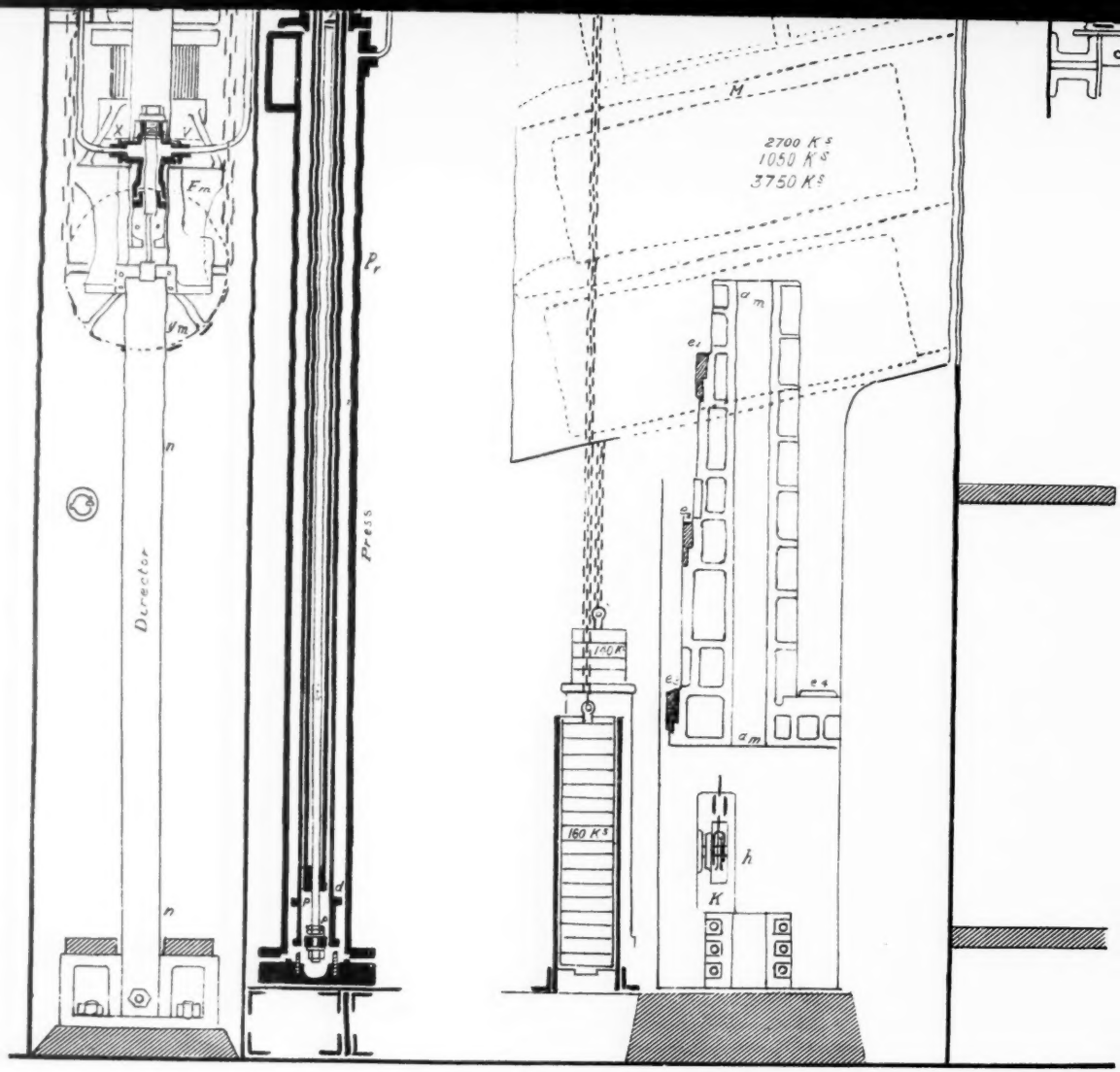


Plan of underside of Platform.

Fig. c.





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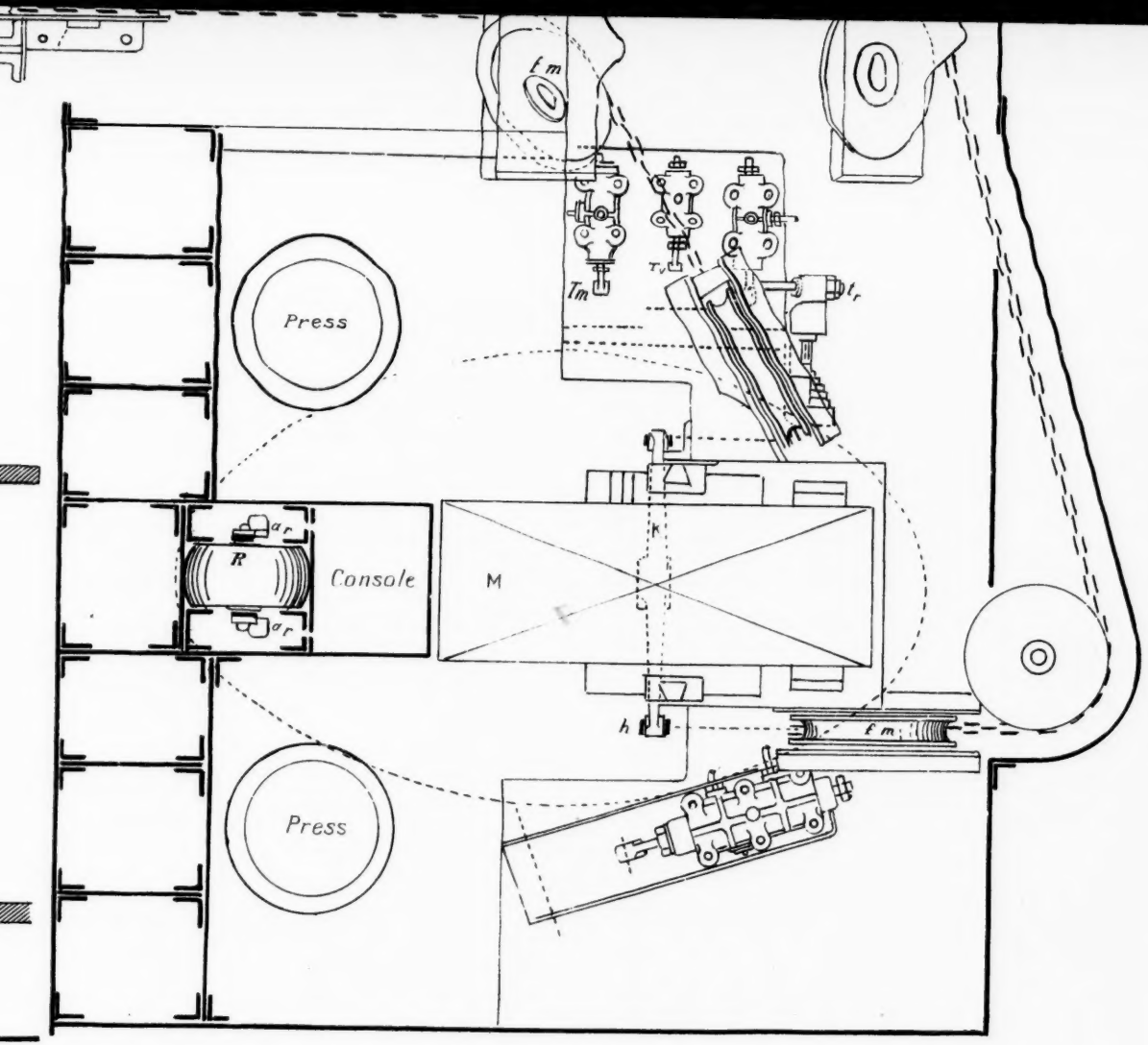
Press
Console
R
M
Press

Fig d

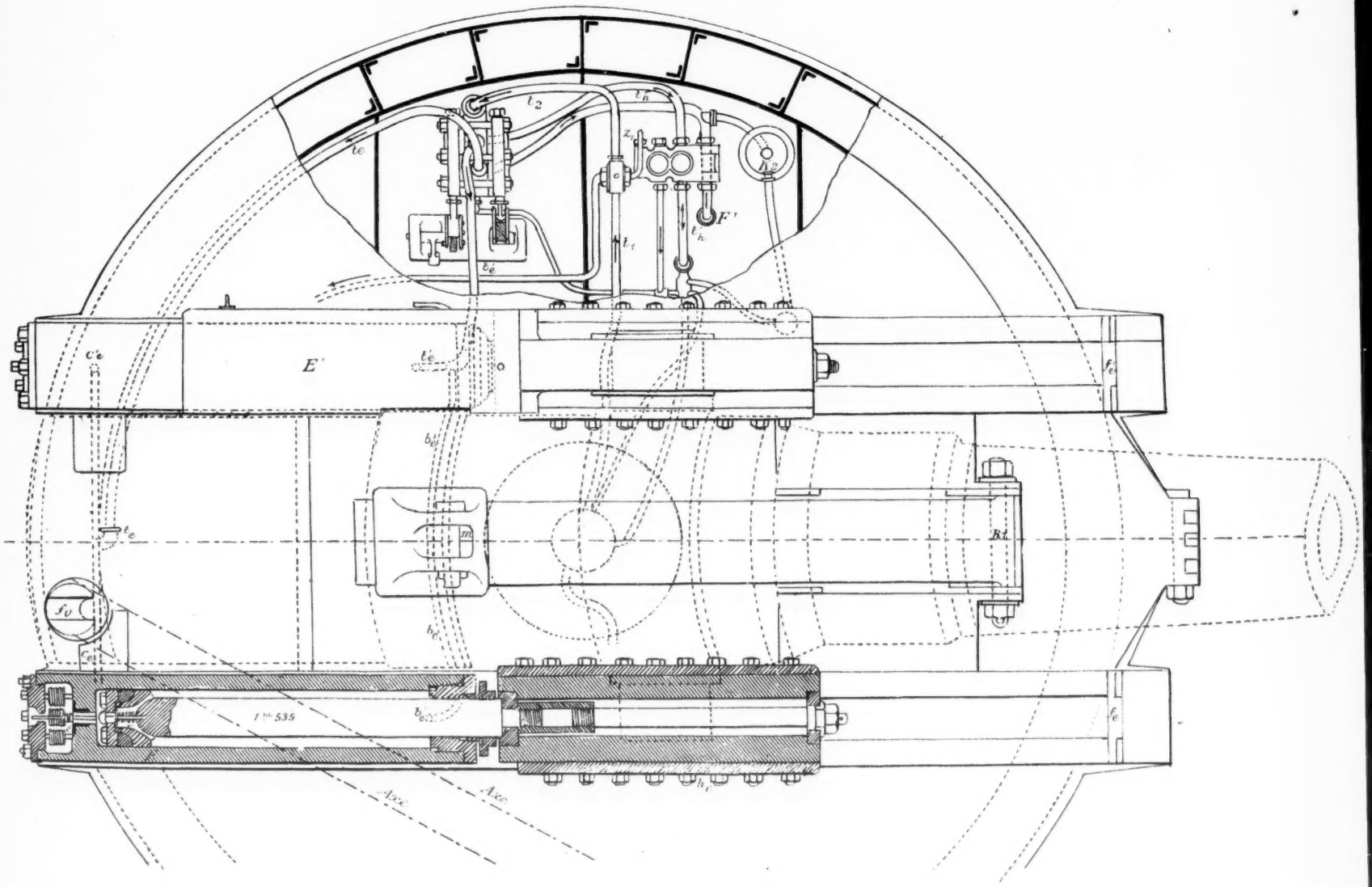

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Fig. a.

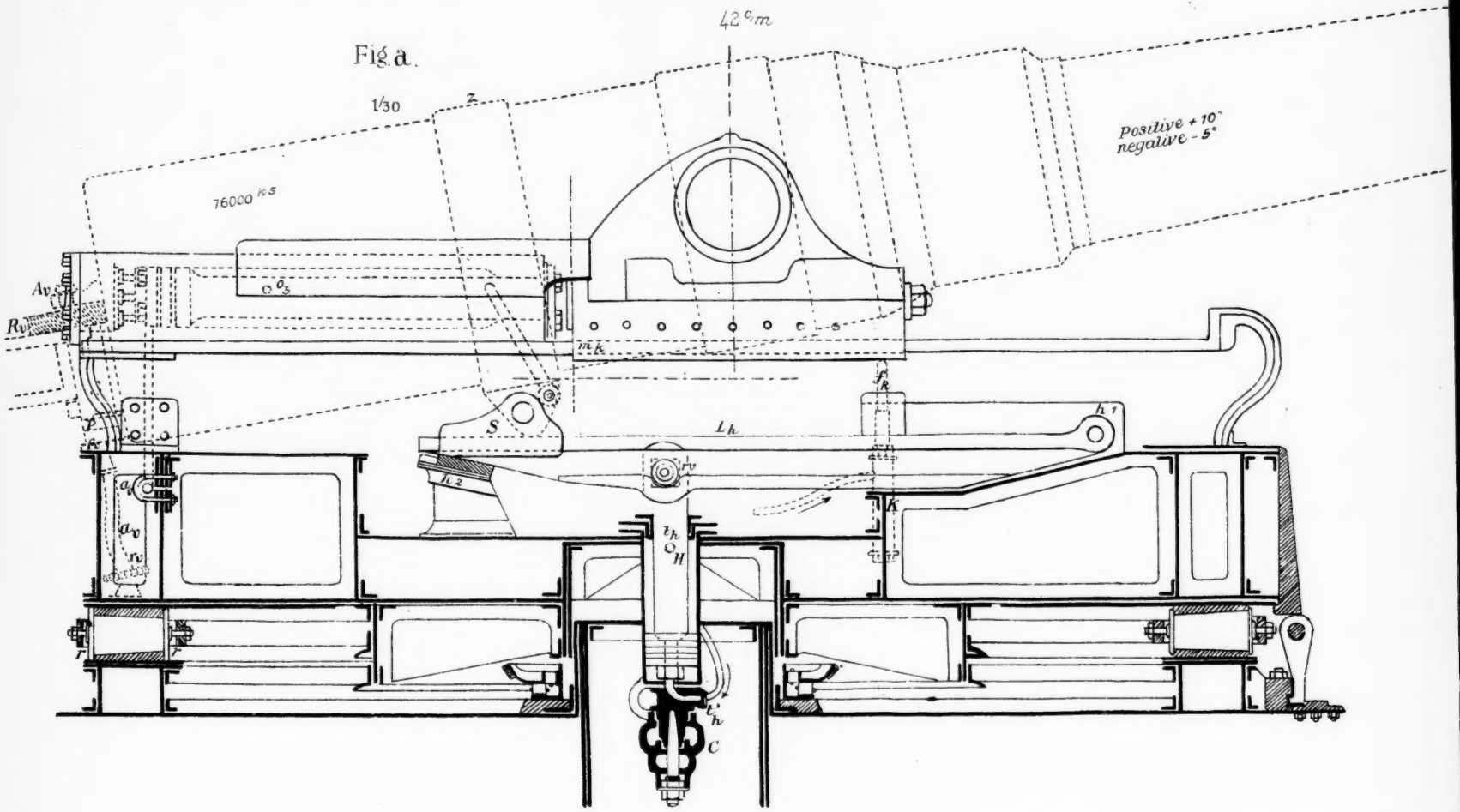


Fig d

Fig.c.

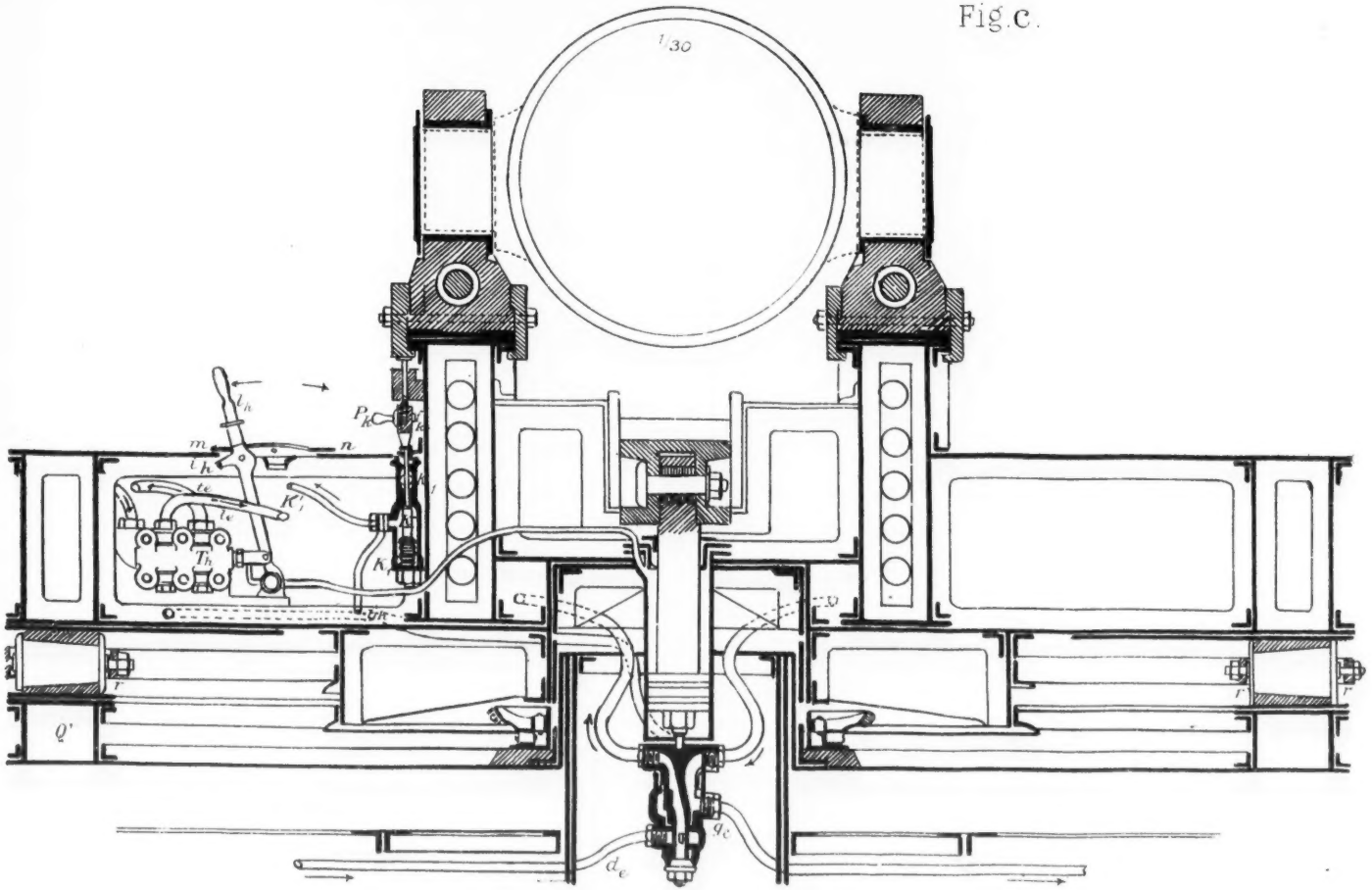
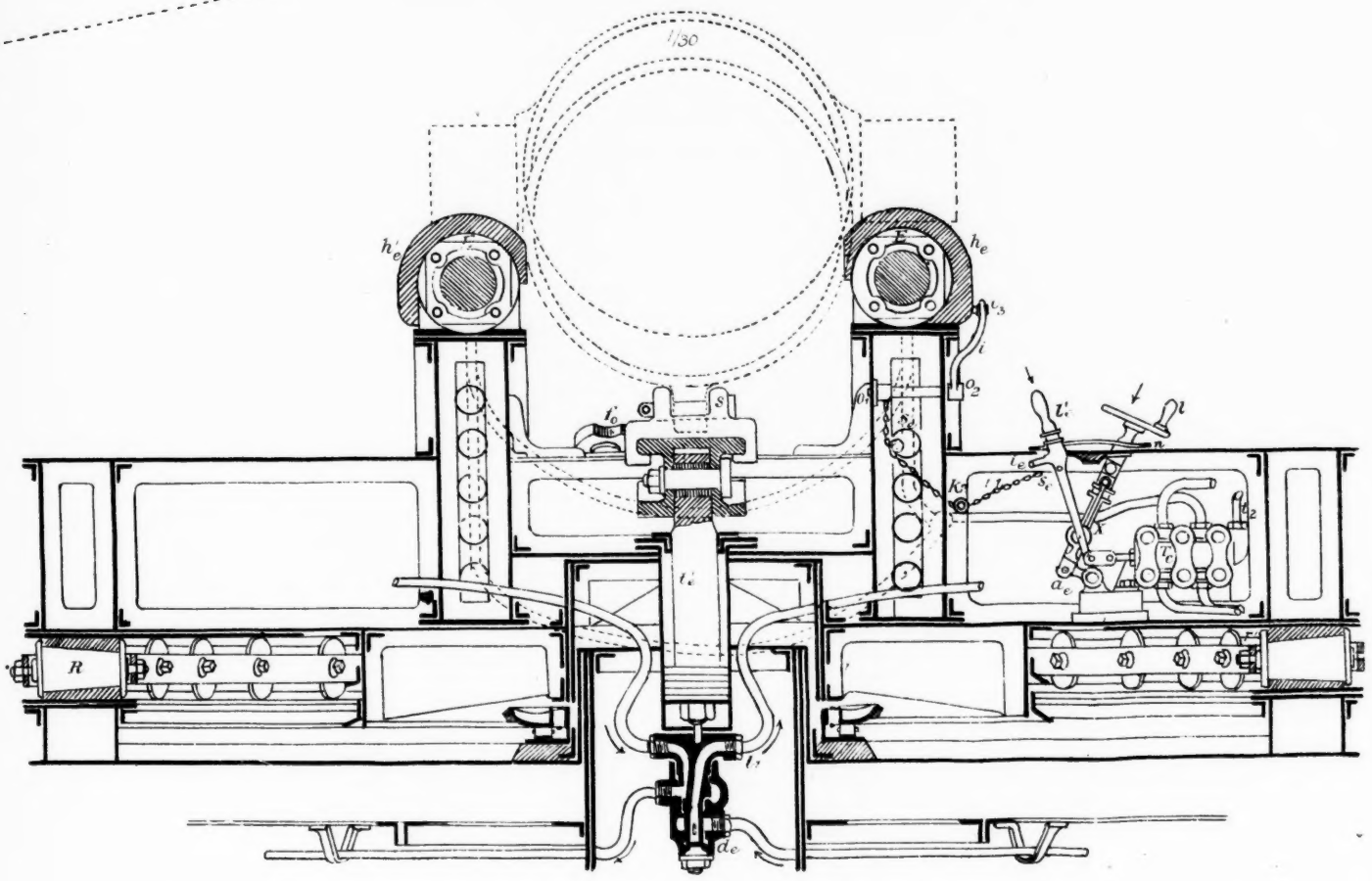


Fig b.



Safety Arrangements.—These form a highly-ingenious combination, and a very interesting speciality of these mountings, and are of such an instructive nature that we will describe them by the help of Fig. 14. The levers for the distribution slide valve are on the right of the gun, fitted on the movable platform in the following order:—1. For running in and out. 2. For the elevating gear. 3. Breech-working gear. 4. Ammunition hoist. The positions of the corresponding levers before and after loading can be seen by the figure:—

1. The lever *A* is placed at "en batterie"; the gun is therefore run out.

2. Lever *B* is at zero, *o*, and the gun is horizontal.

3. Lever *C* of the breech is at "ferme," and the breech is consequently closed.

4. Lever *D* is at "descend," and fixes the lowest position of the ammunition hoist (in the magazine).

These levers are connected to each other by rods and catches, so that in working them a certain rotation must necessarily be observed; these catches are either single or double armed, working on a fixed pivot, and always determine the position of the neighbouring levers. It will be seen by the combination of these crank levers that the elevation, to a certain extent, dominates the others, as its lever *B* can be worked freely both for elevating and lowering, and determines unalterably the positions of the other levers. Further, it is to be observed that the lever *A* remains constantly at the "run out" (*en batterie*) position, which would give rise to difficulties in firing if it were not for automatic valves, fitted so as to allow the water locked up in the return pipes to overflow at the instant of firing. At the end of the recoil the "run-out" gear comes again automatically into action, and the gun is run out without any interference on the part of the gunner. In order to have a correct idea of the co-operation of these levers, all the operations which are necessary to bring the gun in all respects ready for firing are described in proper rotation:—

(*a*) Since the gun is run out, it must first be placed at extreme elevation, as it can only be loaded in this position. For this reason the lever *B* is placed at "positive," and the rod *a″* is drawn to the left, which places the crank arm *a a′* at such a position on its fixed pivot that its end *a′* takes on the bolt *b* of the lever *A*, and fixes its position; and so long as the gun is at extreme elevation it cannot be run in.

(*b*) The breech must then be opened by means of the Lever *C*. In placing the lever *B* the end *p′* of the crank arm *p p′* is put out of reach of the bolt *p″*, and it would be possible to work the lever *C* if it were not held by the bolt *V*. This bolt only releases the breech lever when the gun is quite lowered—that is, when the boss *n* on the slide pushes the lever *E* to the left, and by means of the rod *k* at its lower end, and the bell-crank lever *f f′* draws the bolt *V* out of gear, and frees the lever *C*. This lever can now be placed at "ouvre," admitting the pressure to the breech press. From this instant the elevating lever *B* cannot be moved, as the end *p′* of the breech lever *C* takes on the bolt *p″* of the

elevating lever, and fixes it in position; a second safety arrangement is provided, as the cylinder of the breech apparatus has a projection *w*, which gears into a spiral groove of the shaft *u*, by its movement causing the latter to revolve, by which the bolt *S* is geared into a recess on the lever *B*, and holds it fast so long as the breech is open.

(*c*) The ammunition can now be hoisted, as, after the breech lever has been placed at "ouvre," the hooked-shaped crank arm *v* is thrown out of gear, and releases the bolt *r* of the carriage lever *D*, which can now be placed at "monte." This brings the lower surface *l l'* of the crank-arm *v* over the before-mentioned bolt *r* of the lever *D*, and although allowing free movement of the latter (as the surface *l l'* is formed to suit the path of the bolt *r*) it fixes the position of the breech lever *C* during the ascent of the ammunition carriage. In this way the whole of the levers are secured, and after loading, the carriage lever *D* is placed at "descend," which frees the breech lever *C*, and the breech could be closed before the carriage is clear of it. In order to prevent this, there is another bolt *T*, worked by the cover of the ammunition tube, and so fitted that it fixes the hand lever *C* of the breech as soon as this sliding cover is opened, so that the breech cannot be closed until the ammunition carriage has descended into the tube, and the door is closed.

(*d*) After the ammunition is placed the rammer is swung on its pivot into position, and held by a spring; and in order to fix the ammunition carriage during the operation of loading, a chain *jj* is fitted to the rammer, led over rollers, and hooked to the lever *H*, and carrying a counterbalance weight to keep it in tension. Whilst the rammer is in the loading position the lever *H* is drawn to the left, and holds the lever *D* fast in the position "monte."

(*e*) After the operation of loading is completed, the rammer is swung back to its idle position, and lever *D* is freed.

(*f*) The lever *D* can now be placed at "descend," and the carriage lowered, and as soon as it is below the door of ammunition hoist, and this sliding door closed, the bolt *T* is withdrawn, and lever *C* freed.

(*g*) The breech lever can be placed at "ferme," and as the breech begins to close, the projection *w* turns the shaft *u* back again, and so frees the lever *B* of the elevating gear.

(*h*) Finally, the gun can be laid, and through the raising of the gun the stop bolt again takes in the recess of the breech lever *C*, and holds it fast, as well as the lever *D* of the ammunition carriage until the loading re-commences.

NAVAL AND MILITARY NOTES.

NAVAL.

HOME.—The following are the principal appointments which have been made: Captains—F. Powell, C.B., to "Crescent"; R. N. Gresley to "Bonaventure"; W. W. Moore to "Research"; Spencer H. M. Login to "Centurion"; C. J. Balfour to "Rupert"; A. P. M. Lake to "Inflexible"; C. E. Gissing to "Retribution," as Senior Officer on the South-East Coast of America; R. W. White to "President," as an Assistant-Director of Naval Intelligence; G. L. Atkinson to "Active," as Commodore in Command of Training Squadron; A. F. St. Clair to "Edinburgh"; C. J. Barlow, D.S.O., to "Empress of India"; A. Barrow to "Endymion"; H. L. Royle, D.S.O., to "Calypso"; H. C. Bigge to "Pique"; and L. Wintz to be Naval Attaché in the United States. Commander—W. Ricketts to "Ferret."

The first class cruiser "Crescent" has been commissioned as Vice-Admiral Erskine's flag-ship on the North American and West Indian Station, where she will relieve the "Blake," which will return to England with Vice-Admiral Sir J. Hopkins; the "Crescent" left Portsmouth for her station on the 2nd inst. The new second class cruiser "Retribution" relieves the "Sirius" as Senior Officer's ship on the South-East Coast of America; the "Pique," a sister-ship, relieves the "Leander," a cruiser of an old type, in China. The "Rainbow," also one of the new second class cruisers, which was commissioned last month to relieve the "Severn" in China, has left for her station, and it is highly satisfactory to record that on her three hours' full-speed commissioning trial her engine-room staff were able to maintain a mean speed of 19 knots.

The officers and crew of the belted cruiser "Aurora" have been turned over to the second class battle-ship "Dreadnought," which will take her place as first reserve ship on the West Coast of Ireland. The first class battle-ship "Sanspareil," which has arrived home from the Mediterranean, is to be paid off at Sheerness, and will re-commission the following day as the flag-ship of the Commander-in-Chief at the Nore, in place of the second class battle-ship "Thunderer," whose officers and ship's company will turn over to the "Sanspareil." The "Thunderer" is to take the place of the coast-defence ship "Rupert" as port guard-ship at Pembroke, the "Rupert" proceeding to Gibraltar, where she will relieve the gun-boat "Bramble" as Senior Officer's ship at that port. The "Gannet," sloop, lately returned from the Mediterranean, has been paid off, all standing, and if, after survey, she is found in a satisfactory condition, will be fitted for service as a training-ship for boys.

A few months ago the Admiralty directed that cordite charges were to be supplied in the place of black powder to the ships of the Channel Squadron for use with 6-inch quick-firing guns. These charges were supplied for experimental purposes, and the captain of each ship was directed to have the cordite stowed in the hottest magazine of his ship, in order to test it as severely as possible. Directions were also given that the cordite was to be used exclusively for practice. As a result of the experience thus gained, the Admiralty have decided to considerably extend the issue of cordite ammunition, and to have it issued for all types of quick-firing guns. The first ships to be supplied with it will be the special service vessels in commission in home waters, the tenders attached to the several coast-guard ships, and the battle-ship and gun-boat tenders attached to the "Excellent," gunnery school-ship at Portsmouth, and the "Cambridge" at Devonport.

A new electric signal lamp has been submitted to the Admiralty, and as a result of the experiments to which it has been subjected, it stands a good chance of replacing the multiple fibre lamp now in use on many vessels. The new lamp is partially charged with hydro-carbon vapour instead of, as is the case in all the other types, generating its incandescence in a vacuum. Several of them have been sent to the "Defiance," torpedo school-ship at Devonport, for the purpose of a series of experiments, which are being carried out under the joint direction of Flag-Captain Bouverie F. Clark (Royal Naval Barracks), Captain R. H. Hamond (Cambridge), and Captain J. E. Meryon, who have been requested to report the results at the earliest opportunity. The experiments will be unusually interesting, as the hydro-carbon lamp will be tried against the multiple fibre type of 16-candle-power, the comparative tests being for clearness, brilliancy of light, and speed in signalling. The main object of the experiments will be to ascertain how rapidly the new lamp can be distinctly flashed, and if in this respect it surpasses the multiple fibre lamp its adoption for service use is certain, even if the brilliancy of its light is less than that of the multiple fibre pattern.

We understand that some successful experiments have been carried out on board the "Barfleur" with a new electric motor for working heavy guns by electricity, the invention of Messrs. Seaman. The motor, enclosed in a case of about 2 feet by 1 foot 6 inches, is attached to the guns, the electricity being supplied from the dynamo engine on board, and by simply turning a handle the pointer moves to the indicator for either elevating or depressing the guns, when the machinery is set in motion, giving an upward or downward movement to the weapon as may be required. The time occupied in the operation of elevating or depressing the guns 30 degrees was only 30 seconds, the work being done by one man, whereas by hand-power it would take several men much longer to perform the same operation. The motor was also used for loading the guns, and answered remarkably well. By the use of electric motors much inconvenience will be remedied, as heavy guns often get disabled by a slight mishap to the hydraulic gear, or to the auxiliary steam engine. The Seaman motor does not interfere with the hand gear already fitted to the guns, but is an auxiliary to it, and its value in the working and loading of heavy guns is reported to have been proved in a most convincing manner, the apparatus having been tested in the presence of the principal gunnery officers at the Admiralty and the Gunnery Schools.

The building of the new battle-ship "Illustrious" has at last commenced at Chatham. The first keel plate was laid in No. 6 dock on Monday, the 18th March, in the presence of Captain Lord Charles Beresford, and the principal officers of the yard. The state of preparation of the material for the keel may be judged from the fact that in two days the entire length—390 feet—of the central, flat, and vertical plates, forming the basis on which the whole structure of the vessel will be built, were put upon the blocks. A number of her frames are already in position, and at the end of the week the weight of material worked into her was nearly 150 tons. Thus Chatham enters again for a shipbuilding race with Portsmouth, where the "Majestic," "Prince George," and the "Cæsar" are in course of construction, as against the "Magnificent," "Victorious," and "Illustrious" at the first-named yard. The Admiralty sanctioned an expenditure of £27,639 upon the vessel during the last financial year, and in this year's estimates she figures to the amount of £237,426.

The first keel-plates of the "Cæsar," the third of the new battle-ships building at Portsmouth were laid down on the 25th of March. Like the "Illustrious," at Chatham, a considerable sum is to be spent on her during the ensuing year.

The construction of the new battle-ship "Magnificent" is progressing rapidly towards completion at Chatham. So far as the machinery contractors, Messrs. J. Penn & Sons, of Greenwich, are concerned, their work in the machinery space of the ship is nearly finished. Both sets of engines are completely fitted on board, and are now preparing for the water test, and all the boilers with their

uptakes are in place and the decks and casings closed up. Satisfactory progress is also being made with the armoured parts of the ship, and great hopes are entertained of the vessel being so far advanced by the early summer as to enable her trials, which are looked forward to with special interest, to be then made. Her propelling machinery embodies a new departure in boiler engineering, the steam being supplied from boilers fitted with a new system of creating an increased draught in their furnaces when an extra demand is made upon them for a larger developed power by the engines.

The following torpedo-boat catchers are to form the flotilla to be attached to the Reserve in the Medway, and may soon be expected to arrive :—The "Janus," "Lightning," and "Porcupine," constructed by Palmer's Shipbuilding Company; the "Haughty" and "Hardy," built by Messrs. Doxford and Sons, Sunderland; the "Salmon and Snapper," from Earle's Shipbuilding Company, Hull; the "Swordfish" and "Spitfire," from the works of Sir W. G. Armstrong, Mitchell, and Co., Newcastle-on-Tyne; the "Sunfish," "Opossum," and "Ranger," built by Messrs. Hawthorn, Leslie, and Co., Newcastle-on-Tyne; the "Dragon," from Messrs. Laird Brothers; and the "Zebra," from the Thames Ironworks Company. The "Hotspur," coast-defence vessel, is ordered to be removed from the basin at Chatham Dockyard to Saltpan Reach, in the River Medway, to make room for these fourteen vessels.

The torpedo flotilla at Devonport at present consists of about twenty first class torpedo-boats and two torpedo-boat destroyers, and within the next four months twelve more destroyers are expected to arrive for permanent attachment to the Fleet Reserve. With the exception of the boats attached to the "Defiance," all the flotilla are now berthed off Keyham, and as these moorings are inside the landing of the dockyard extension, they will have to be removed before the extension can be commenced. It is proposed that for all the torpedo-boats new moorings be laid off Petre Point, on the western side of the Hamoaze, and that the torpedo-boat destroyers be berthed at moorings on the same side of, but nearer the mouth of the harbour. The most important feature of the proposal is that two battle-ships of the "Northumberland" type are to be appropriated as depôts—one as parent ship to the destroyers, and the other to the torpedo-boats. The expense of this arrangement would, it is believed, be very trifling, as except during the naval manœuvres, or in case of emergency, little, if any, addition would be required to the skeleton crews now employed in the Fleet Reserve ships.

Four more torpedo-boat destroyers have been launched—the "Fervent," building by Messrs. Hanna, Donald, and Wilson, at Paisley; the "Swordfish," from the Elswick ship-yard; the "Janus," from Messrs. Palmer's yard at Jarrow; and the "Bruiser," from Messrs. Thornycroft's yard at Chiswick. The "Janus" will be supplied with four of Reed's patent water-tube boilers, while the engines have been specially designed by the Jarrow firm.

The torpedo-boat destroyers "Rocket" and "Shark," constructed by Messrs. James and George Thomson, Clydebank, have completed their official trials on the Clyde. Each vessel made six runs on the measured mile at Skelmorlie, the following being the mean results :—

	"Rocket."	"Shark."
Revolutions, Port Engine	399	400
Revolutions, Starboard Engine	397	397
Vacuum	25 inches.	25 inches.
Steam	188 lbs.	184 lbs.
Air Pressure	3·5 inches.	3 inches.
Speed	27·7 knots.	27·5 knots.

The dimensions are the same as in other vessels of the type: length, 200 feet; beam, 19 feet 6 inches; and the draught, 5¼ feet. They have straight stems, and exceptionally fine lines, the wave resistance having been reduced to the minimum. The machinery, designed at Clydebank by Mr. J. G. Dunlop, consists of two sets

of triple expansion engines, the cylinders being 18⅛ inches, 26⅝ inches, and 40⅛ inches diameter respectively, with a stroke of 18 inches. Piston valves have been adopted throughout, with the usual double eccentric and link motion valve gear. All moving parts have been balanced. Steam is supplied from four water-tube boilers of the Normand type, the grate area being 163 square feet and the heating surface 8,600 square feet.

The "Surly," the last of the three torpedo-boat destroyers which the same firm are building for the Admiralty, also concluded her official trials on the 15th ult. in the Firth of Clyde. She is exactly similar to the "Rocket" and "Shark." The weather was of the most unfavourable description. Rain fell heavily from the start, and there was a strong breeze from the south-west. The vessel left Clydebank shortly before ten o'clock, and proceeded direct to Skelmorlie. On six runs over the measured mile her mean speed was 27·6 knots—the corresponding revolutions being 398—which even under the unfavourable conditions was in excess of the guarantee. To complete the three hours' continuous steaming stipulated in the contract, the run was continued down the firth. Outside the head wind was, if anything, stronger, and the sea less favourable to fast steaming ; but the pace actually improved as the trial advanced, and when the return voyage was commenced, just to the south of Arran, the little vessel steamed very fast, and with a smoothness that reflected the greatest credit on her builders. In the "Surly" Messrs. Thomson have progressed, for at the end of her three hours' run the mean speed came out at 28·05 knots, the revolutions being 405. The "Rocket's" average on the measured mile, it may be added, was 27·7 knots, and on the six hours' run 27·4, and the "Shark's" were 27·5 and 27·6 respectively.

The official speed trials of the "Bruiser," the last of the five torpedo-boat destroyers, ordered to be built and engined by Messrs. Thornycroft and Co., of Chiswick, took place on Friday, 29th ult., at the mouth of the Thames in very bad weather. The vessel left Greenhithe shortly after 10 a.m., and on reaching the trial ground six runs were made on the measured mile, when a mean speed of 28·144 knots was realised. The contract conditions being a three hours' run at a speed of 27 knots, the trial, notwithstanding the state of the weather, was successfully completed, the mean speed attained for the three hours being 27·97 knots, or practically 28 knots. The "Bruiser" is fitted with engines capable of developing 4,500-I.H.P., supplied with steam from water-tube boilers on Messrs. Thornycroft's patented principle. As the weight carried by all naval vessels on their official trials largely influences the results attained, the trial of the "Bruiser" in such weather as she experienced was considered very satisfactory.

The torpedo-boat destroyer "Sturgeon," built and engined by the Naval Construction and Armaments Company of Barrow, whilst waiting her official trial in the Clyde, has made a series of progressive trials. On Monday, the 18th ult., she was taken for a three hours' run under trial conditions, with a result that a speed of 28·1 knots was reached on the mile and a speed of 27¾ knots on the three hours. The engines of the "Sturgeon" are of the three-stage compound type usual with these vessels ; the chief point of interest being the boilers, which are of the new Blechynden water-tube type, of which four are fitted. The working pressure of 200 lbs. to the square inch was, we understand, maintained with the greatest ease with 2½-inch air pressure, and the working throughout was most satisfactory. This is the first vessel fitted with the new type of boiler, the latter differing from other small tube boilers in the fact that each tube can be drawn and replaced without disturbing its neighbour or undoing large flanged and bolted joints.

A Parliamentary paper of some interest, which may be useful for purposes of reference, has recently been issued with reference to the expenditure under the Naval Defence Acts of 1889 and 1893. Full particulars are given of the expendi-

ture provided for in the acts. The Government were authorised to expend ten million sterling on contract vessels, a similar sum on dockyard-built vessels and surveying, equipping and completing contract vessels, whilst £2,850,000 was set down for the armament of dockyard vessels. Of this sum, down to March 31st, 1894, £21,668,624 has been spent, leaving £739,376 unexpended.

The most interesting portion of the return is the report of the Controller and Auditor-General. After dealing with the expenditure of these large sums of money, he proceeds to draw a comparison of cost as between vessels built by contract and in H.M. dockyards. He states, "The figures in the expense accounts have been adopted for this purpose, inasmuch as they appear to present the fairest basis for comparison, including as they do on both sides a levy for incidental expenses in connection with building, which has no place in the Naval Defence account in consequence of such indirect expenditure not being chargeable under the Act to Naval Defence Funds. The comparative results show that dockyard shipbuilding is more favourable in the case of first class battle-ships, but not so economical, so far as can be judged, by aggregate cost, under the other types, while it is noticeable that dockyard results under the same types vary considerably *inter se*. I have called the attention of the Admiralty to the facts, with a view to any explanation being afforded that their lordships may think it desirable to offer."

Comparison of cost of completed vessels built by contract and in H.M. dockyards respectively, as shown in appendix to expense accounts, 1893-94 :—

CONTRACT.		DOCKYARD.	
Name of Ship.	*Total cost.*	*Name of Ship.*	*Total cost.*
First Class Battle-ships.			
Ramilies	£899,321	Hood (Chatham)	£846,299
Resolution	870,703	Empress of India (Pembroke)	844,124
		Royal Sovereign (Portsmouth)	837,148
First Class Cruisers.			
Endymion	£362,637	Royal Arthur (Portsmouth)	£406,224
Gibraltar	361,166	Crescent (Chatham)	387,827
Grafton	361,255	Edgar (Devonport)	408,198
		Hawke (Chatham)	396,265
Second Class Cruisers.			
Indefatigable	£182,863	Andromache (Chatham)	£189,329
Intrepid	183,284	Æolus (Devonport)	212,383
Iphigenia	184,997	Apollo (Chatham)	190,214
Latona	173,251	Bonaventure (Devonport)	247,373
Melampus	174,402	Brilliant (Sheerness)	216,557
Naïad	173,997		
Pique	187,693		
Rainbow	187,019		
Retribution	187,846		
Sappho	175,988		
Scylla	175,751		
Sirius	190,276		
Spartan	189,068		
Terpsichore	175,908		
Thetis	175,171		
Tribune	174,977		
Torpedo Gunboats.			
Jaseur	£50,184	Alarm (Sheerness)	£62,397
Jason	50,127	Circe (Sheerness)	65,568
Niger	49,801	Gleaner (Sheerness)	66,327
Onyx	56,019	Glossamer (Sheerness)	63,344
Renard	55,953	Hebe (Sheerness)	73,799
Speedy	61,383	Leda (Sheerness)	62,639

NOTE.—The cost of contract ships includes an approximate levy for Admiralty incidental charges on building, in order to render the comparison more complete.

H. M. S. "Revenge" was passed into the Fleet Reserve in March, 1894, but the record of expenditure was not quite complete in 1893-94.

DENMARK.—As was foreshadowed in the Budget, 1895-6 (Naval Notes, December, 1894), the following vessels have been commissioned for various services:—The cruiser-frigate "Fyen," with a crew of 300 officers and men, for a four months' cruise in Trans-Atlantic waters; the cruiser-corvette "Dagmar," as training-ship for naval cadets for a three months' cruise in European waters, with a crew of 195 men; the sailing-brig "Örnen," with a crew of 105 men, for a five months' cruise as a training-ship for petty officers. For service at home, to carry out target practice, and to serve as cadet-training ship, the cruiser "Absalon" and a first class torpedo-boat; the cruiser "Diana," for five-and-a-half months' service in Iceland, for protection of the fisheries; for the same purpose in home waters, the gun-boat "Grönsund" and the surveying vessel "Hauch." The Manœuvre Squadron is constituted as follows:—Battle-ship "Odin" (flag-ship), coast-defence ship "Gorm," the gun-boats "Möen" and Öresund," the torpilleurs-de-haute-mer "Delfinen" and "Svœrdfisken," fourteen second class boats, and some mining-vessels. Later on the new cruisers "Hekla and "Geiser" will be commissioned, and with four torpedo-boats will represent the Danish Fleet at the opening of the North-Sea and Baltic Canal.

For scientific purposes the cruiser "Ingolf" commissions in the beginning of May, and proceeds with an expedition to Greenland, which is to survey in those waters as well as in Baffin's Bay and to collect material for the continuation of a scientific work, "Conspectus Faunæ Groenlandicæ," which is being published under the auspices of the Ministry of Marine. The head of the expedition will be Commander Wandel, the Director of Naval Archives, and he is accompanied by a scientific staff of botanists, etc. For the use of the expedition coal has already been despatched to the West Coast of Iceland and to several colonies on the West Coast of Greenland.—*Neue Preussische Kreuz Zeitung.*

FRANCE.—The following are the principal appointments and promotions which have been made:—Capitaine de Vaisseau Le Borgne de Kerambosquer to be Rear-Admiral; Capitaine de Frégate Barnaud to be Capitaine de Vaisseau; Lieutenant de Vaisseau Hiart to be Capitaine de Frégate. Rear-Admirals—De Maigret to command of a division of the Active Squadron of the Mediterranean, vice Gadaud; Abel de Libran, placed on retired list. Capitaines de Vaisseau—Antoine to "Dévastation"; Boutet to "Alger"; Barnaud to command of Submarine Defences at Toulon. Capitaines de Frégate—Debar to "Flamme"; Saint Paul de Sincay to the "Heroine" and the Naval Command in Senegal; Havard to "Papin."—*Le Moniteur de la Flotte.*

Vice-Admiral Gervais, in command of the Reserve Squadron of the Mediterranean Fleet, has temporarily shifted his flag to the "Terrible," while the "Richelieu," his flag-ship, is undergoing some slight repairs. Rear-Admiral de Maigret has hoisted his flag on board the "Dévastation," and taken over the command of the Levant Division of the Active Squadron of the Mediterranean Fleet. Rear-Admiral Fournier, in command of the Atlantic Division, will return to Brest in his flag-ship, the first class battery-cruiser "Duquesne," at the end of May, when he will strike his flag, and his successor will hoist his on board the same ship, which will re-commission for another two years' service. The first class armoured cruiser "Charner" and the aviso "Parseval" are in future to be known as the "Amiral Charner" and the "Amiral Parseval."

The repairs and alterations to the first class battle-ship "Hoche" are now nearly completed, and she is to be ready for commissioning by June to take the place of the "Suffren," as flag-ship of the Channel Squadron. The change will add materially to the strength of the squadron, as the "Suffren" is a very old ship, built of wood, and, being without water-tight compartments, her fighting value is *nil*. The Minister of Marine has given orders to push on with the work

on board the "Hoche," as he is anxious that she should form part of the squadron to be present at Kiel at the opening of the Baltic Canal, and it has been found impossible to provide the necessary accommodation for an Admiral and his staff either on board the "Jemmapes" or the new armoured cruisers. The new coast-defence battle-ship "Valmy" has commenced her trials at Brest with very satisfactory results; during a preliminary six hours' run she averaged for two hours under forced draught a speed of 16·7 knots, with a mean of 112 revolutions of the engines; the remaining four hours were run under natural draught.

The first class armoured cruiser "Latouche-Tréville" has made another 24 hours' speed trial, which is considered satisfactory; the average mean speed was 16·8 knots, with 110 revolutions of the engines and an I.H.P. of 5,250, the consumption of coal being 677 grammes per H.P. per hour. The second class cruiser "Friant" has renewed her trials at Brest, and on the 15th March made a satisfactory trial on the measured mile under forced draught; there was a heavy sea on, but the average speed maintained was nevertheless 18·8, and on some runs she made 19·3 knots. The engines developed 9,503-I.H.P., being 400-H.P. over the contract, with 126 as the mean number of revolutions; while the consumption of coal was 8,600 kilogrammes per hour, being 911 grammes per H.P. for the same time. A sister-ship, the "Chasseloup-Laubat," has also re-commenced her trials, the substitution of light signal masts for her heavy military ones and other alterations to increase her stability having been carried out. At a run over the measured mile off Cherbourg, with the engines making 125 revolutions, a speed of 18·7 was attained, the consumption of coal being 809 grammes per H.P. per hour.

The torpedo-cruiser "Wattignies," having completed her repairs, has been fully commissioned, and after her trials will join the Active Squadron of the Mediterranean Fleet; while the "Vautour," a vessel of the same class, has been placed *en disponibilité armée* and temporarily attached to the Reserve Squadron while in the dockyard hands.

The new torpedo-aviso "Cassini" has commenced her trials at Cherbourg, and at a preliminary full-speed run made 20 knots with 150 revolutions of the engines. Some modifications in her machinery are to be made before she re-commences her trials, which will consequently have to be deferred some weeks, The new torpilleur-de-haute-mer "Filibustier," built by M. Normand, of Havre. has commenced her official trials, and on a preliminary full-speed run realised a mean speed of 25·6 knots with 360 revolutions, which is rather more than half-a-knot in excess of the contract. She is a vessel of 120 tons, and is fitted with Du Temple boilers, and it is hoped that on her final trials she will make 26 knots. The torpilleur-de-haute-mer "Agile" has been placed in the second category of the Reserve at Toulon, and her place in the Reserve Squadron has been taken by a sister-vessel, the "Audacieux." The new torpilleur-de-haute-mer "Lansquenet," which entered on her trials more than a year ago, but in whose machinery and ventilating arrangements it was found necessary to make important alterations, has at last made a very successful trial, having attained a speed of 27 knots.

The following official arrangements have been announced for the present quarter:—The Squadron of the North (Channel) will complete to its full complements on the 1st June for four months. It is hoped that the "Hoche" will be commissioned in May to replace the "Suffren," which will then be placed in the third category of the Reserve, and also that the "Dupuy-de-Lôme," the "Friant," and "Chasseloup-Laubat" will be able to join the squadron to proceed to Kiel for the opening of the North-Sea and Baltic Canal. The new second class cruiser "Bugeaud" and the new gun-boat "Surprise" are to commission for their trials, as well as the second class battery-cruiser "Dubourdieu"; the third class barbette-cruiser "Hugon" returning from the East Indies, is to pay off at Lorient. At Toulon, the first class battery-cruiser "Cécille" is to commission for her trials, and will then relieve a similar vessel, the "Tage," in the Active Squadron of the

Mediterranean Fleet, which latter ship is to join the Squadron of the Reserve; the first class battle ship "Redoubtable," on completion of her trials, also rejoins the Active Squadron of the fleet; the new torpedo-aviso "Cassini" is to join the Mediterranean Fleet on the conclusion of her trials, and the Reserve Squadron of the Mediterranean Fleet will complete to their full effectives on the 1st July for one month.

Fifteen 37-millimetre Maxim guns have been delivered and apportioned to various ships, by order of the Minister of Marine, for thorough trial under Service conditions. Nine are to be mounted on ships of the Active Squadrons, five on ships of the Reserve Squadron, and one on board the "Couronne," the gunnery school-ship at Toulon; each gun will be supplied with 1,000 rounds. The charge of 33 grs. of ordinary powder gives an initial velocity of from 400 to 410 metres, which is the same as the velocity obtained from the Hotchkiss guns; but Mr. Maxim has invented a special powder, which is expected to give an initial velocity of from 530 to 550 metres.—*Le Yacht, Le Moniteur de la Flotte,* and *Le Temps.*

Referring again to the Budget for the year as finally approved, we find that the Active Mediterranean Squadron is to consist of nine battle-ships, seven cruisers, seven torpedo-cruisers and avisos, and six torpilleurs-de-haute-mer:—

First class battle-ships—"Formidable" (flag-ship of Vice-Admiral de la Jaille, Commander-in-Chief), "Dévastation" (flag-ship of Rear-Admiral de Maigret), "Magenta" (flag-ship of Rear-Admiral McGuckin de Slane), "Amiral Baudin," "Courbet," "Marceau," "Neptune," "Redoutable," and "Brennus." It is, however, quite uncertain at what date the last-named will be ready to join the fleet.

First class armoured cruisers—"Chanzy" and "Amiral Charner." Very uncertain how soon these two vessels will be ready.

First class battery-cruiser—"Cécille."

Second class cruiser—"Suchet."

Third class cruisers—"Cosmao," "Troude," "Lalande" and "Linois." The last-named has only just commenced her trials.

Torpedo-cruisers and avisos—"Faucon," "Vautour," "Wattignies," "D'Iberville," "Léger," "Levrier," and "Cassini." The latter only commencing her trials.

Torpilleurs-de-haute-mer—"Ariel," "Argonaute," "Chevalier," "Corsaire," "Mousquetaire," and "Forban." This last—which is building by M. Normand, at Havre, and is to steam 30 knots—has not yet been launched.

The ships of the squadron are manned by 451 officers and 8,550 men.

The Reserve Mediterranean Squadron is to be composed of five battle-ships, four cruisers, two torpedo-avisos, and two torpilleurs-de-haute-mer:—

Battle-ships—"Richelieu," flag-ship of Vice-Admiral Gervais, Commander-in-Chief; "Amiral Duperré," flag-ship of Rear-Admiral Turquet de Beauregard.

Coast-defence battle-ships—"Caïman," "Terrible," "Indomptable."

First class battery-cruisers—"Sfax," "Tage."

Third class cruisers—"Forbin," "Milan."

Torpedo-avisos—"Bombe," "Dague," and the torpilleurs-de-haute-mer "Dragon" and "Téméraire."

The squadron will complete to their full effectives for one month, and will remain with reduced crews for the rest of the year. In the Budget provision is made for 2,879 officers and men for the squadron. As compared with 1894, the Active Squadron has this year one battle-ship and one cruiser less, but there is an additional torpedo-cruiser; the Reserve Squadron is reduced in strength by two battle-ships and two torpilleurs-de-haute-mer.

The Squadron of the North is to consist of six battle-ships, six cruisers, four torpedo-cruisers, and three torpilleurs-de-haute-mer, but there seems to be some

uncertainty as to what vessels will actually compose the squadron. According to the Budget, the squadron will be formed as follows :—

Battle-ships—"Suffren," flag-ship of Vice-Admiral Alquier, commander-in-chief; "Victorieuse," flag-ship of Rear-Admiral Ménard; "Hoche."

Coast-defence battle-ships—"Jemmapes," "Requin," "Bouvines." This latter has only lately begun her trials.

Armoured cruisers—"Latouche-Tréville," "Dupuy-de-Lôme." This last not through her trials.

Second class cruisers—"Friant," "Chasseloup-Laubat." Neither yet through their trials.

Third class cruisers—Coëtlogon," "Surcouf."

Torpedo-cruisers and Avisos—"Épervier," "Fleurus" (not through her trials yet), "Lance," "Salve," "Archer," "Dauphin," "Lancier."

The number of officers and men voted for the squadron is 2,826. None of the ships are to be kept with their full effectives for the whole twelve months, but are to have reduced complements for different periods. As compared with last year the squadron is weaker by a battle-ship and a torpedo-boat, but has an additional cruiser.

In spite of the "Suffren" having been given in the Budget as flag-ship, there seems to be no doubt that the "Hoche" is to take her place.

GERMANY.—The Emperor arrived at Kiel on the morning of the 3rd instant, being received by Prince Henry and the principal officials; he proceeded to the Dockyard, where all was in readiness for the launch of the new fourth class battle-ship, hitherto known as "T." The Kaiser's dedication speech was as usual characteristic, and as follows :—

"After unremitting toil in the Imperial dockyard, this vessel now stands before us, a monument of German industry, ready to be consigned to its appropriate element. Thou shalt now be numbered among the armoured fighting units of the German Navy, shalt serve in the defence of the Fatherland, and shalt face the enemy with contempt and defiance. The names of the vessels of the same class have been taken from the old German mythology. Therefore, thou too shalt remind us of the grey primeval times of our ancestors, of the great deity who was worshipped and feared by all German mariners, and whose mighty Empire extended from the icy North Pole to the distant South Pole, on whose ocean waves the battles of the North were fought, and death and ruin carried into the land of the foe. Thou shalt bear this great god's potent name. Mayest thou prove worthy of it! I christen thee Ægir."

As has been already mentioned, the new vessel is a considerable improvement on her seven sisters, her plating being composed entirely of Krupp nickel steel. In our description of this class in last month's Notes, we stated that they carried two 9·4-inch guns in the forward barbette, whereas we should have stated that these guns were mounted singly in separate barbette-turrets, sponsoned out one each side forward.

After the launch the Kaiser took up his quarters on board the "Hohenzollern," and the next day he inspected again the works of the New Canal, in which he continues to take great interest, and he was further employed with the various officials concerned in settling the details connected with the opening ceremony. Buoys for the foreign ships are being laid down in the harbour at Kiel, and other preparations made for their reception. Before leaving Kiel on his return to Berlin, on the 6th the Kaiser inspected the "Weissenburg" and the "Hagen.

It seems to have been now decided at the Ministry of Marine that the re-constitution of the Second Division of the Manœuvre Squadron is not to take place until after the manœuvres this year, so that the division will still consist of the "Baden," "Bayern," "Sachsen," and "Würtemberg," Rear-Admiral

Barandon flying his flag in the first-named vessel. The torpedo-boat flotilla attached to the squadron is, as last year, under the command of Corvette-Captain Zeye, who has his Senior Officer's pennant in the aviso "Blitz," and is composed of the A and B Divisions, which consist in each case of a division-boat and six torpedo-boats, and are commanded by Captain-Lieutenants Freiherr von Schimmelmann and Schneider respectively.

It is now definitely decided that the fourth class battle-ships "Siegfried," "Beowulf," "Frithjof," and "Hildebrand" are to be stationed in the North Sea; while the "Heimdall," "Hagen" "Odin," and "Ægir" will form the Baltic Division. The primary duty of these ships is to be the defence of the new North-Sea and Baltic Canal.—*Neue Preussische Kreuz Zeitung.*

ITALY.—The following are the principal appointments which have taken place:—Vice-Admirals—Racchia to command of the Squadron of the Reserve; Accinni to command of the Active Squadron. Rear-Admirals—Quigini from command of 2nd Division of the Reserve Squadron to service at Ministry of Marine; Grandville to command of 2nd Division of the Reserve Squadron, and to hoist his flag on board the "Sardegna."—*Gazzetta Ufficiale.*

It seems to be now quite settled that the Italian Squadron, which is to be present at Kiel for the opening *fêtes* of the Baltic and North-Sea Canal, will also pay a visit to Portsmouth in return for the visit of the Mediterranean Squadron to Tarento in the Autumn of 1893. It is reported that H.R.H the Duke of Genoa will command the squadron.

Last year the Naval Academy at Leghorn underwent re-organisation. In 1881 it took the place of the old schools at Naples and Genoa. The course of study was normally for five years, the last two of which were devoted solely to professional subjects. At the end of the fourth year, the cadets who showed an aptitude for engineering work could pass into that branch of the Service; while at the end of their studies, those who felt disinclined to become combatant officers, could join the non-combatant branch. The programme has now been completely changed. The limit of age for entry, which was fifteen years, is now nineteen, so that the course of secondary education has been done away with, and the Academy has now special sections for the different branches, and technical studies. There are two courses each year: one, from the 15th November to the 15th June, is carried out entirely on land; while for the second, which lasts from the 1st July to the 1st November, the cadets are embarked on board the training ships. Each course is followed by an examination. The normal length of study is three years, but there are supplemental courses. Great advantages are expected to accrue from this re-organisation.—*Revue Maritime et Coloniale.*

A singular arrangement has been made between the Ministers of Marine and Finance. A certain number of torpedo-boats are to be placed at the service of the Custom House, and will be used as police-boats and be at the disposal of and be paid by the Minister of Finance. The *Popolo Romano* considers it both a practical and advantageous combination of duties, as it will afford employment and consequent instruction in these boats for a larger number of men. On Lake Guardia "9 T" and "10 T" and two of White's turnabout picket-boats will be stationed; on Lake Maggiore "19 T" and "21 T" and a White's picket-boat; at Venice "7 T" and "8 T"; at Ancona "147 S"; in Sicilian waters "78 S," "86 S," and "92 S"; and on Lake Lugano "4 T" and "20 T." The torpedo-boats "S" (Schichau) will be commanded by lieutenants, and the smaller ones "T" (Thornycroft) will be commanded by warrant officers.

It is stated that the force in the Red Sea is to be increased, Massowah being the headquarters, and that the station will be placed under the command of a Rear-Admiral.

The troop-ship "Eridano," launched in 1884, of 2,970 tons and 2,500-I.H.P., has been fitted out at Venice as a surveying ship, and will take the place of the "Washington," which, after thirty years' service, has now been condemned as no longer seaworthy.—*Italia Marinara.*

SPAIN.—On the 12th March was launched, from the ship-building yard of Messrs. Vea Murgia and Co., at Cadiz, the first class armoured-cruiser "Emperador Carlos V." The Queen Regent had been invited to perform the ceremony of launching the vessel, but being unable to be present on account of illness, Her Majesty delegated the Countess de Niebla to represent her. The Minister of Marine, Señor Pasquin, and the Minister for Home Affairs, Señor Pingcerver, were present, representing the Government. Over 20,000 people assembled to witness the launch, which was attended with great rejoicing.

Neither Brassey, Durassier, nor the *Marine-Almanach* agree as to her dimensions, but the *Revista General de Marina*, of March (the naval periodical published at Madrid), in a detailed description of the ship, gives her dimensions as follows:—Length between perpendiculars 375 feet, extreme 400 feet, beam 66 feet, and with a displacement of 9,235 tons her mean draught is 25 feet. The hull has been built by Messrs. Vea Murgia and Co., Siemens-Martin steel being used, and there is an armour belt of 2-inch steel (1 inch of Siemens steel, and the other inch of chrome steel), which runs for a length of 165 feet amid-ships, shut in at each end by armoured athwart ship bulkheads with the same thickness of plating. The protective deck is of steel, the maximum thickness being 6⅛ inches, made up of three plates. The armament consists of two 28-centimetre (11·02-inch) Hontoria guns, eight 14-centimetre (5·5-inch) Hontoria quick-firing guns, four 10-centimetre (4-inch), and two 7-centimetre quick-firing guns, four 57-millimetre and four 37-millimetre Nordenfeldt guns, two machine guns (mitrailleuse), and six Schwartzkopff torpedo tubes. The two 28-centimetre (11·02-inch) guns are mounted in barbette turrets, one forward and one aft, which are protected by 10-inch steel armour, with 4-inch steel hoods, and the ammunition tubes are also protected by 8-inch steel armour. The eight 14-centimetre quick-firing guns are mounted on the upper deck, protected by 2-inch steel shields, the two foremost and two after ones firing from right ahead and right astern to 70° fore and abaft the beam.

The twin engines are of the four-cylinder triple-expansion type, there being two 52-inch high-pressure cylinders, two 77$\frac{3}{4}$-inch intermediate, and four 82$\frac{3}{32}$-inch low-pressure cylinders, the piston stroke being 45$\frac{5}{16}$-inch. Steam at 147 lbs. pressure is supplied by twelve single-ended boilers, 16 feet 3$\frac{5}{8}$ inches in diameter by 9 feet 10⅛ inches long. The engines are to develop 15,000-I.H.P., giving a speed of 20 knots under forced draught. The screw propellers, which are of bronze, have each four blades. The vessel has bunker capacity for 1,771 tons, which gives her a radius of action of 12,000 sea miles at 10 knots. The machinery was constructed by the Maquinista Terrestre y Maritima, Barcelona.

The cost of the vessel is 18,350,000 pesetas, which at the present rate of exchange, is equal to about £680,000.

A gun-boat built for the Spanish Government for service in the Philippines was launched from the Kowloon Docks, Hongkong, on January 24th. The following are the principal dimensions and particulars:—Length over all, 145 feet 3 inches; breadth, 22 feet 10 inches; depth moulded, 11 feet; tonnage, builders' measurements, 347 tons. The engines are triple expansion; diameter of cylinders, 13, 21, and 35 inches, with a stroke of 24 inches; estimated I.H.P., 1,500. Steam will be supplied by two single-ended circular multitubular boilers, with a working pressure of 170 lbs. per square inch. The armament consists of two 57-millimetre Nordenfeldt guns, one placed at the bow, the other at the stern; also two Hotchkiss 5-barrel guns mounted on sponsons at the sides. Each gun has an arc of training of 180°.

The "Reina Regente," lost last month in the hurricane which swept over the Straits of Gibraltar, was a first class protected cruiser of 5,000 tons, with engines developing 11,590-I.H.P., giving a speed of 20 knots, and was a comparatively new vessel, having been launched in 1887. She was 318 feet 6 inches long, with a beam of 50 feet, and she was heavily armed, which may have had something to do with the catastrophe, as there seems to have been a general opinion that the ship was top-heavy, carrying, as she did, four 20-centimetre (7·8-inch) guns, two each side in sponsons on the poop and forecastle, and six 12-centimetre (4·7-inch) guns on the broadside, besides smaller quick-firing guns. She, moreover, had military tops high up on her masts. Her loss with all hands is a sad blow to the Spanish Navy.

UNITED STATES.—Rear-Admiral Meade, at present commanding the Atlantic Division, has the satisfaction of finding himself at the head of the most efficient and powerful squadron which has been collected under the United States flag for a great many years past. The squadron is constituted as follows :—

Armoured cruiser—"New York" (flagship).

First class cruisers—"Columbia" and "Minneapolis."

Second class cruisers—"Raleigh," "Cincinnati," and "Atlanta."

All these ships, with the exception of the "Atlanta," are quite new ships and under forced draught can make their 20 knots easily; even the "Atlanta," which was launched in 1884, is good for 16 knots.

Navy Department officials are highly gratified with the excellent results obtained from the 6-inch smokeless powder manufactured at the Newport Naval Station. The highest velocity obtained with this powder was 2,495 feet per second with only 15·1 tons pressure, in a gun of 40 calibres. The Troisdorf 6-inch powder, which was also tested under almost similar conditions, gave as its highest velocity only 1,904 feet per second, with 15·9 tons pressure, in a 35-calibre gun.

By some interesting experiments lately conducted with loaded shell, at the Indian Head Proving Grounds, the superiority of gunpowder over guncotton, so far as destructiveness is concerned, was clearly shown. Two 4-inch shells, manufactured by the United States Projectile Company, were discharged in powder chambers, the first loaded with ordinary black powder and the second with wet guncotton. The powder shell smashed the chamber and set fire to the woodwork, and the wet guncotton, while it made a great noise, did comparatively little damage. These experiments were made as a result of the battle off the Yalu River, during which, according to the reports received at the Navy Department, the powder shells discharged inflicted incalculable damage, setting fire to the woodwork of the ship and causing splinters to fly in all directions, to the injury of the men in the vicinity. The experiments with powder for use in shell will be continued by the Naval Ordnance Bureau, and if the results continue to be as satisfactory, the probabilities are that, in future, the shells for the ships of the Navy will be loaded with it, instead of the high explosives now in use.

Some interesting armour-plate tests for the new battle-ships have lately been carried out. A test 17-inch plate from the armour for the "Indiana" and "Massachusetts" was tried at Bethlehem, Pa., February 19th. Carpenter shell and Brown hexagonal powder was used. First a 500-pound projectile was fired with 166 pounds of powder from a 10-inch gun; velocity, 1,539 feet. The shell was broken up, and its point was welded to the plate by the great heat generated. The penetration was estimated at about 2 inches. Not the slightest crack was shown. The second projectile was of the same kind and weight as the first one, but the charge of powder was 241 pounds, the heaviest ever fired on the grounds. The projectile moved 1,940 feet a second. The point of impact was in the centre of the plate, 41 inches from the bottom. The shell was broken up and the point welded in the plate. The penetration was estimated at about 6 inches. Neither

the backing nor bolts were disturbed by either of the shots, and there was comparatively little or no curving of the plate.

There were two important ballistic tests of armour plate last month at the Indian Head Proving Grounds. The first was a test for acceptance of a plate representing a group of 18-inch Carnegie harveyized armour for the belt of the "Oregon," and the result was perfectly satisfactory. The second was the trial of a new process, and its inability to keep out armour-piercing shell was clearly demonstrated. The 18-inch plate was held in position against a 36-inch oak backing by twenty armour bolts of ordinary size. The gun was 12 inches in calibre, and the line of fire for both shots was within one degree to the normal. The first shell fired was a Carpenter armour-piercing projectile. The charge was 295 pounds of brown powder, and the velocity 1,458 feet per second. The shell weighing 850 pounds struck the plate almost half-way between the top and bottom, and about a foot and a half from the centre, the energy at impact being something more than 11,000-foot tons. The shell broke up on the face of the plate, its head welding into the metal. As far as could be estimated the penetration did not exceed 5 inches. There were absolutely no cracks. A slight front bulge was visible at the point of impact. The plate scaled somewhat around the place where it had been struck, but not so much as is ordinarily the case. No bolts were disturbed. The second shot was for penetration. Like the first, it was a Carpenter armour-piercing projectile, weighing 850 pounds. The charge was 443 pounds of brown powder. The velocity was 1,925 feet per second. This shell struck the plate about 3½ feet from the impact already made on the other side of the centre and about 3½ feet from the top. After penetrating 7 inches it broke up and re-bounded, leaving, however, its head welded into the face of the plate. The plate was cracked completely in two across its width. The appearance of the metal about the point of impact was similar to that of the first shell. An examination of the metal where the plate was cracked showed it to be remarkably tough. Its performance was excellent, and resulted in the acceptance of the group which it represents.

The second plate tested was manufactured by the Midrah Steel Company. It was an experimental piece of armour which had been treated by what is known as the Gantz-Chase process. This process, according to ordnance officials, is nothing more than the application of a chrome face to steel plate. Armour similar in character was tested last September at the Army Proving Grounds at Sandy Hook, and on the first fire it was smashed to pieces. The same results attended the plate tried lately. It was 5 feet square and 10 inches in thickness. The first shell, a Carpenter armour-piercing projectile, weighing 100 pounds, fired from a 6-inch gun, with a velocity of 2,104 feet per second, struck on one side of the plate some distance from the centre. The shell was stopped and broke up, but the plate itself suffered severely from the impact, being cracked to pieces.

Another 14-inch plate of Harveyized armour supplied by the Carnegie Company was also tried and subjected to a striking velocity of 1,859 feet a second. The point of the projectile went in about 7 inches, and it was "upset" completely, the great projectile scattering in small bits. Not the slightest crack was developed in any part of the armour. Although struck point-blank by a shell having the highest penetrating velocity required under Service conditions, practically no damage was done. It was next treated as a 15-inch plate, with a 500-lb. projectile, having a striking velocity of 1,940 feet a second, the maximum for the 10-inch gun. There were 241 lbs. of brown hexagonal powder behind this shot, which struck close to its predecessor, in the same vertical line. It crumbled to pieces, leaving a disfiguring hole and a lot of fused metal where it hit, but the plate showed no crack, not even where it had presumably been weakened by the first attack. Finally a shot was fired from the 12-inch gun with a striking velocity of 1,858 feet a second. It bored a clean hole through the plate, but its tremendous blow failed to develop even a radial fracture. No further tests were deemed

necessary, as this was the ordeal to which 17-inch armour is subjected, and the 14-inch plate was evidently unequal in resisting power to the barbettes of the "Oregon," "Indiana," and "Massachusetts." It resisted cracking better than they had done, however. This is the result of experiments made by the Carnegie Company, whose managers conceived the idea that the resistance of a Harveyized plate might be increased by re-heating and mashing it under rollers subsequent to the completion of the American surface carbonisation process, and after thus toughening its texture and minimising its internal strains, spraying its face with ice-water to secure the advantages of chilled hardening. A 17-inch plate similar to those made for the barbettes of the battle-ships was treated in this manner and reduced to a thickness of 14 inches. It had the usual wooden backing, and was attacked by a 10-inch gun under all the conditions attending the trial of a 14-inch plate.—*Army and Navy Journal.*

MILITARY.

HOME.—The following changes on the Staff of the Army took effect on the 1st April :—Major-General Sir Baker Russell, K.C.B., K.C.M.G., succeeds Lieut-General J. H. Hall in the command of the North-Western District at Chester; Major-General Viscount Frankfort de Montmorency takes up the command of the Dublin District; Major-General G. Luck, C.B., becomes Inspector-General of Cavalry in Great Britain and Ireland; Colonel F. M. Wardrop, C.B., succeeds Lieut-Colonel Dawson, Coldstream Guards, as Military Attaché at Vienna; Colonel H. H. Settle, D.S.O., R.E., takes over the appointment of an Assistant Inspector-General of Fortifications at Headquarters; Colonel V. Chater assumes command of the 25th Regimental District at Berwick-on-Tweed; Lieut-Colonel J. G. Y. Wilson, Army Service Corps, takes up the appointment of Deputy Assistant Adjutant-General, Cork; Major C. A. Hadfield, Army Service Corps, becomes a Deputy Assistant Adjutant-General, Headquarters, Ireland; Captain W. H. Rycroft, 7th Dragoon Guards, takes over from Major Sinclair, R.E., the appointment of Deputy Assistant Adjutant-General of the North-Eastern District, York; and Captain E. H. Paterson and Captain J. G. E. Wynne, Royal Artillery, become instructors at the School of Gunnery, and Captain C. R. M. Lane and Lieutenant A. R. Oldfield, Royal Artillery, second-class assistant inspectors of warlike stores at the Royal Arsenal.

On the 1st inst., under the Act of Parliament of 1893, the orders for the re-organisation of the Army in India came into force, and the military control hitherto exercised by the Governors in Council of Madras and Bombay ceased. Under General Sir George White, as Commander-in-Chief in India, the Bengal Army will be divided into two portions, the Punjaub and the Bengal, and these, with the armies of Madras and Bombay, will form the four great commands of the future, under respectively Lieut-General Sir W. Lockhart, K.C.B., Lieut-General Sir W. K. Elles, K.C.B., Lieut-General Mansfield Clarke, C.B., and Lieut-General C. E. Nairne, C.B. The Punjaub command is to contain three first class districts, Lahore, the Punjaub Frontier Force, and Rawul Pindi, and two second class, Peshawur and Sirhind; the Bengal two first class, Meerut and Oude, and six second class, Allahabad, Assam, Bundelkund, Nerbudda, Presidency, and Rohilkund; the Madras two first class, Burma and Secunderabad, and six second class, Bangalore, Belgaum, Madras, Mandalay, Rangoon, and Southern; and the Bombay three first class, Mhow, Poona, and Quetta, and five second class, Aden, Bombay, Deesa, Nagpore, and Sind. Each of the four commands will reckon in its strength the British troops stationed within its borders, and of native troops there are allotted to the Punjaub command fifteen regiments of cavalry, five

batteries of artillery, and thirty-seven regiments (forty battalions) of infantry; to the Bengal command nine regiments of cavalry, two batteries of artillery, and twenty-two regiments (twenty-four battalions) of infantry; to the Madras command three regiments of cavalry and thirty-two regiments of infantry; and to the Bombay command seven regiments of cavalry, two batteries of artillery, and twenty-six regiments of infantry. Madras and Bombay will retain their corps of sappers and miners, and no alteration is made as to the Hyderabad contingent and other local corps. The re-organisation scheme provides for a full staff for each of the four great commands and for the Commander-in-Chief.

The following changes in the organisation of the Royal Artillery have been decided upon:—The Royal Horse Artillery and Field Artillery, at home, will be composed of—on the higher establishment (six guns), five and thirteen batteries respectively; and on the lower establishment (four guns), five and thirty-two batteries respectively, the depôts consisting in each case of one battery. The depôts for these branches, as at present constituted, will be abolished, and a depôt battery for each branch will be charged with the reception, clothing and elementary training, not exceeding eight weeks, of all recruits for the mounted branches. The three divisions of garrison artillery will remain as at present, with the exception that the sub-depôts at Leith Fort, N.B., Templemore, and Woolwich, will be converted into service companies and allotted to stations at home. The remaining depôts for garrison artillery will receive, clothe, and kit all recruits for the garrison artillery from the several recruiting areas, and pass them to service companies after a short training in elementary drills. The batteries and companies of the several branches of the regiment serving abroad, will be kept up to their establishment by drafts from batteries and companies of their own branch or division serving at home. Batteries of horse and field artillery on the higher establishment will furnish no drafts for batteries abroad.

The Commander-in-Chief, in a regimental order just issued to the Royal Artillery, announces that an increase in the number of service units has been approved to the extent of one horse battery, seven field batteries, and six garrison companies. The horse battery will be formed from the A Depôt Battery, and the new field batteries by detachments taken from other batteries and depôts, to be designated—the 81st at Trowbridge, the 82nd, 84th, 85th, 86th, and 87th at Woolwich, and the 83rd at Glasgow. Of the new garrison companies four are to be added to the Southern Division, and be quartered in Ceylon, Singapore, Leith Fort, and Portsmouth, being formed from companies or depôts already in those places, with added drafts, and two to the Western Division—one at the Cape of Good Hope from No. 25 Company, now stationed there, and the other at Milford Haven from No. 3 Sub-Depôt of the Southern Division.

AUSTRIA-HUNGARY.—The past year has seen several important modifications introduced into the organisation of the Army, and it may be of interest to give a short *résumé* of the principal ones.

I. *The Active Army.* 1. *The Infantry.*—The increase of the effective peace-footing of companies, commenced in 1893 and continued last year, will be finally completed in 1895. Each company will consist of three officers and ninety-two men (three officers and 128 men in Bosnia-Herzegovina), the number of lieutenants in each company being gradually increased from two to three. In 1894 the effective of each regiment was increased by one superior officer and one captain.

The regiment of Tyrolean Chasseurs, whose strength has been increased in 1894 by the addition of four superior officers, is to be broken up this year into four new regiments of four war-battalions and one depôt-battalion. The anomaly of a body of troops with an abnormally high effective will thus cease.

The twenty-six battalions of "Chasseurs-indépendants" received last year an additional captain, and this year a first lieutenant is to be appointed as officer of pioneers.

2. *The Cavalry.*—The Budget has provided for the creation in the month of November, 1895, of a new divisional command, which will raise the number of these commands on a peace-footing to five.

The number of subaltern officers was increased in 1894.

The Depôt-Cadre will receive in the future the larger portion of the supernumerary horses and men, and will be charged with the duty of training the remount horses.

3. *The Artillery.*—In 1894 the re-organisation of the field artillery was completed. There have been formed fourteen new mounted batteries, which were to be brought up to their effective strength of ninety-two men and forty-two horses on the first of this month.

The fourteen corps regiments and the forty-two divisional regiments each include four mounted batteries of four guns (in time of war eight guns); the artillery of each Corps d'Armée (with the exception of the 15th) is composed of one corps regiment and three divisional regiments; ten of the corps regiments furnish a mountain battery, and eight between them a group of two horse artillery batteries of six guns each. The Tyrol possesses a group of three mountain batteries, and the number of the pack animals is to be increased this year. The number of artillery subalterns has also been increased.

The fortress artillery has received an addition of two cadres batteries, intended to form the nucleus of groups of mobile batteries, to be raised to seven.

4. *Technical Troops.*—The new organisation of these troops, formed into fifteen battalions of pioneers, was carried out last year, and will be completed by an increase of strength during 1895, so that each battalion will consist of five companies for war service.

The Budget for 1895 makes provision for the formation of a cadre for balloon service; the strength of the officers of the railway and telegraph regiments has also been increased.

5. *The Engineers.*—With the 1st January, 1895, the new organisation of the "État-Major" of the engineers came into force, on which, for the future, will devolve the sole charge of the fortifications; the work of construction of military buildings is delegated to a special category of *employés,* who are called "Ingénieurs des Constructions Militaires."

The officers of the "État-Major" of the engineers are to follow the courses of the technical Military Academy and the superior course of engineering; they are also to serve a certain time in the infantry. The "État-Major" consists henceforth of three Generals, ten Colonels, fifteen Lieut-Colonels, eighteen Majors, sixty Captains, and forty assistant-officers—in all, 146; before the new organisation there were 233 officers on the staff; it is necessary, however, to add to the present strength three superior officers and sixteen Captains attached to the military schools. At the head of the "État-Major" is placed a General as Inspector of Engineering.

The number of "Directions" has been raised from thirteen to fourteen, with their headquarters as follows:—Cracow, Pola, Klangenfurt, Comorn, Przemysl, Karlsburg, Peterwardein, Brixen, Trente, Cattaro, Sarajewo, Mostar, Trebinje, and Bilek. In the Tyrol and in Bosnia there is also one "Direction of Fortifications."

To each headquarters of a territorial Corps d'Armée is attached a superior officer or Captain of the "État-Major" of the engineers; the chiefs of engineers of the Corps d'Armée have been abolished. The corps of engineers of military buildings is placed under the orders of an Engineer-General, and comprises twenty-seven engineers-in-chief, fifty-six ordinary engineers, twelve supernumeraries, and a certain number of foremen and *employés* for office work, etc. In each Corps d'Armée there is a section of these engineers under the orders of a Director.

6. *The Military Technical Committee.*—The special technical courses of lectures are at present as follows :—

(*a*) The special technical course for Captains of artillery.
(*b*) The school of gun-practice for artillery.
(*c*) The higher course for artillery and engineers.

II. *The Landwehr.*—1. *The Cisleithan Infantry Landwehr.*—According to the terms of the new law re-organising the Cisleithan Landwehr, the period of service of the men directly incorporated therein is fixed at two years in the Active Landwehr and ten years in the Landwehr Reserve. In order to insure the obtaining of "sous-officiers," certain advantages are offered to those who consent to complete a third year of active service.

In order to give full effect to the new regulations, the peace-effective has been placed on a higher footing than formerly ; last year two officers and sixty-two men were added to the infantry battalions, so that the increase in the effective of the Cisleithan Landwehr battalions has now reached eleven officers and 172 men.

2. *Cisleithan Landwehr Cavalry.*—Three regiments of dragoons have been turned into the same number of regiments of uhlans, thus increased to six. In each regiment, in case of war, will be formed six squadrons in place of four, and one squadron at the depôt. The cadres of each regiment have been considerably increased ; their effective now stands at twenty-nine officers, 283 men, and 210 horses. The cadres of the "Provincial Mounted Rifles" (for the most part Tyrolean and Dalmatian) have also been increased.

At the Cisleithan Ministry of War, there has been formed a special independent section, charged with all that concerns the Landsturm.

A Field-Marshal-Lieutenant has been appointed to the command of each of the eight territorial Landwehr commands, who in war time will command the eight Cisleithan Landwehr divisions.

A great extension has also been given to the Landwehr military schools.

A certain number of new measures relating to the Landsturm also come into force this year ; nine superior officers have been attached to the Landwehr commands for duties connected with the Landsturm.

The regiments of infantry (twenty-three) are to have the cadres of a battalion of Reserve.

In each Landwehr battalion district has been formed a Landsturm district command, which is responsible for everything connected with the Landsturm.

The result of the various additions has been to raise the effective of the Cisleithan Landwehr, which now stands as follows :—Two "Feldzeugmeisters" (Generals), nine Field-Marshal Lieutenants (Lieut-Generals), ten Major-Generals, forty-two Colonels, fifty Lieut-Colonels, seventy-eight Majors, 426 first class Captains of infantry and cavalry, 146 second class infantry Captains, nineteen second class cavalry Captains, 554 First-Lieutenants, and 334 Lieutenants. If we add the doctors and military functionaries, we have a total of 2,006 officers, as against 1,573 in 1892.

The Budget has increased in the last three years from 13 million francs to 21 millions.

There is now no restriction as to the employment of the cavalry of the Cisleithan Landwehr beyond the boundaries of Cisleithania.

III. *Transleithan Landwehr.*—The organisation of the Transleithan Landwehr has always been more complete than that of the Cisleithan, but last year various increases were made both to the peace-effectives of the infantry and the hussars. This year there will be a further increase of the effectives of the hussar regiments, which in the future, on a peace-footing, will consist of thirty officers, 417 men, and 331 horses ; and in time of war, of fifty-six officers, 1,482 men, and 1,471 horses.

In order to increase in time of peace the number of trained horses, it has been decided that the duty of training shall be carried out at the depôt, in accordance with the system carried out in Cisleithania.

Finally, the Hungarian Landsturm are to be armed with the magazine rifle (model 1888-1890).—*Revue Militaire de l'Étranger.*

BELGIUM.—Experiments were made quite recently at Cureghem, a suburb of Brussels, in presence of many foreigners, with a new rifle, the invention of M. Marga, an officer in the Belgian Army. The main feature in the invention is the cartridge, which is so arranged as to contain what are practically two charges. These are fired in succession. The extraordinary muzzle-velocity of 3,000-foot-seconds was attained. The sole objection to the new weapon seems to lie in the increased cost and labour of filling the cartridge.

The grand autumn manœuvres this year will be carried out between the 2nd and 14th September. The first infantry division (1st, 2nd, 3rd, and 4th regiments) will first go into camp on the 2nd August at Beverloo for musketry practice, will be joined on the 24th August by eight mounted batteries of the 1st regiment of artillery and by the cavalry, and on the 2nd September it will move against Antwerp, which will be defended by the 2nd division. The 2nd infantry division (5th, 6th, 7th, and 8th regiments) will go through its musketry practice between the 5th July and 2nd August. On the 31st August it will be joined by six mounted batteries of the 2nd regiment of artillery, and will then proceed to the manœuvre district.

The third division, which includes three brigades, will be divided. The fifth brigade (9th and 10th Regiments) will fire and exercise in the neighbourhood of Arlon, from the 2nd to the 31st August. The two other brigades (11th, 12th, 13th, and 14th Regiments) will remain in camp at Beverloo from the 31st May to the 5th July; after completing their firing, it will manœuvre with a squadron of the 2nd Lancers and three batteries of the 4th Regiment of Artillery, which will join the brigade on the 29th June.

Siege-exercises will take place at Liége between 26th August and the 7th September.—*Revue du Cercle Militaire.*

BULGARIA.—The following changes in the organisation of the Army were carried out last year:—The six batteries of the reserve which were detached to furnish the cadres for the reserve artillery regiments have been brought back to the regimental formations in the proportion of one to each of the six regiments of artillery. The six regiments now consist each of six batteries, or two groups of three batteries.

The three companies of the Train have been divided between the artillery regiment. The six mountain demi-batteries have been formed into three mountain batteries, which are attached to the Field Artillery Regiments, Nos. 2, 3, and 4. The Fortress Artillery has been increased by a fourth battalion of three companies.

Of the six sotnias of divisional cavalry, four have been attached to the four cavalry regiments, to form the fifth squadrons. The remaining two have been constituted into a demi-regiment, and will form part of the cavalry division. In the engineers a fourth group has been formed, consisting of a company of pioneers, a railway company, and a telegraph company.—*Revue du Cercle Militaire.*

CHILI.—The *Revista Militar de Chile* has given some interesting particulars of rifle trials before a special commission appointed to select a new arm for the Chilian infantry. The rifles under trial were the following:—The Mauser (three patterns—7·65 millimetres, 7 millimetres, and 6·5 millimetres); and the Mannlicher, Marga, Beaumont, and Daudetau rifles, each with a calibre of 6·5 millimetres

(·255 inch). The Daudetau gave a velocity (mean of five trials) of 776·5 metres (2,545 feet), surprising the commission by exceeding the small calibre Mauser by 63 metres, the Mannlicher by 64, the Beaumont by 62, the Marga by 59, and the larger Mausers by 74 and 122 metres. The projectile weighed 9 grammes (·315 oz.), those of the other rifles all 10 grammes or more, and the Daudetau powder charge (2·05 grammes) was less than that employed with any of the other rifles. The Mannlicher ball penetrated deal to a depth of 12 millimetres, and the Mauser of 7 millimetres, more than that of the Daudetau. In regard to rapidity of fire, the new rifle gave thirty-seven rounds per minute, compared with twenty-four for the Mannlicher, and twenty-five and twenty-eight for the various Mausers, and the trajectory was also flatter. In regard to accuracy of fire, the rifles were placed in the following order:—Daudetau, Beaumont, Mauser, Mannlicher, at 250 metres; Mauser, Daudetau, Beaumont, Mannlicher, Marga, 500 metres; Mannlicher, Daudetau, Mauser, 1,000 metres. Lastly, in order to test the durability of the weapons, 950 rounds were fired with each, and they came out of the test in the following order:—Daudetau, Mauser, Beaumont, Marga. The excellent results obtained with the Daudetau rifle were a great surprise to the members of the committee.

GERMANY.—The *Journal d'Alsace* gives the following account of the manœuvres that took place in the beginning of February, and in which six regiments of infantry, two regiments of cavalry, and two regiments of artillery took part:—

The 60th Infantry Brigade left Strasburg at 5 a.m., in special trains, for the district between Mittelbronn and Rieding, when it was joined by the 99th Infantry Regiment from Saverne, the 60th Infantry Regiment from Weissemburg, and by detachments of the 15th Uhlans and of the 15th Regiment of Field Artillery. The General Idea was the repulse of a hostile army corps advancing on Strasburg. The enemy was represented by the 97th Infantry Regiment from Sarreburg, the 136th Infantry Regiment from Dieuze, detachments of the 5th Chevaux-légers, and a battery of the 34th Regiment of Field Artillery.

General von Blume and several other Generals were present at the manœuvres, which commenced at 1 p.m. The troops had a very bad time, on account of the snow, which, at some places, was 16 inches deep. The trial was a severe one, especially for young soldiers, who, however, bore themselves bravely, in spite of a temperature below zero, Fahrenheit, and a strong north wind. The manœuvres terminated about 4 p.m., and, on the march back to the bivouacs, some six miles from the field of battle, the regiments left many stragglers behind. The 143rd Regiment of Infantry arrived at Lutzelburg from Strasburg at 9 a.m., marching by Phalsburg to Mittelbronn, and, after the manœuvres, marched a further seven miles to Rieding. At the latter place soup had been prepared in the open air, in addition to which the troops had issued to them a ration of preserved meat and of coffee.

While waiting, with an impatience which may easily be understood, for the trains that were to convey them back to Strasburg, the companies were massed round immense fires lighted in the open. At 8.15 p.m. the 143rd left Rieding, and reached Strasburg at 11 p.m. Tea was issued to the soldiers on their arrival in barracks.—*Revue Militaire Suisse.*

The grand manœuvres this year will be of considerable importance. The whole Guard Corps is to operate against the 2nd Corps d'Armée in the neighbourhood of Stettin. The 2nd Corps, which is numerically inferior to the Guard, will be reinforced by two supplementary brigades of cavalry, which will be attached to the cavalry division acting with the corps. It is not yet settled whether the fleet will co-operate in the manœuvres.

The general scope of the grand manœuvres for next year has already practically been settled, so it is stated. They are to take place in the immediate vicinity of Hamburg, and all the ships of the fleet belonging to both the North Sea and Baltic Squadrons are also to take part. The fundamental idea of the operations, which will be on a larger scale than usual, will be to test the practical use for war of the new North Sea and Baltic Canal. The scene of the manœuvres will be the triangle comprised between Kiel, Flensbourg, Hamburg, and Cuxhaven, including the coast line.—*Hamburghische Freie Presse.*

RUSSIA.—The command of the military district of Vilna has been conferred on General Trotzki, lately second in command to General Dragomiroff, commanding the military district of Kieff. The Vilna district is one of the most important in Russia, both on account of its extent and strategical position, and the strength of the troops quartered in it. The General has under his orders four Corps d'Armée, three divisions of cavalry, two brigades of infantry reserve, and one of Chasseurs. Among other places of importance in the district are Vilna, Kovno, Dvinsk, and Libau.

General Trotzki is not yet sixty, but he has had a distinguished career. Entering the Service at eighteen in 1853, he served through the Crimea and in all the numerous campaigns in Central Asia up to 1875. He obtained his Colonel's commission at twenty-eight, became a Major-General at thirty-five, and Lieut-General at forty-five.—*Revue du Cercle Militaire.*

During the course of the winter the troops of the Warsaw division have, as in previous years, been exercised with the view of accustoming them to the rigours of the cold. The manœuvres have been carried out by detachments of troops of all three arms. The soldiers have been equipped for the field, except that the younger ones have not taken their knapsacks.

The exercise has generally lasted two days, divided by a night of bivouac, during which the men were under shelter of a tent or some covering. The temperature was always very trying, the thermometer often falling at night to 20° below zero. In the tents the temperature generally stood at 4° or 5° below freezing, but it fell occasionally as low as 8° or 9°.

Special precautions were taken with regard to the clothing and the fixing of the bivouac. Knitted vests, drawers, caps protecting the ears, and fur gloves were supplied to the soldiers. They received, moreover, on arriving at the bivouac, straw for sleeping in, as well as wood for fires and for cooking their rations in the small stoves fixed in each tent; ample supplies of provisions and tea were also served out.—*Revue Militaire de l'Étranger.*

SWEDEN.—The Finspong Engineering Company in Sweden is at present busily occupied with the manufacture of various artillery material. Among contracts in hand are three armoured-plated turrets, of the firm's special construction, with guns, and two turrets, capable of being rotated, also with guns; these five turrets are intended for the Vasberg fortifications at Karlsborg. For the Swedish artillery there are in hand twelve 8-centimetre howitzers, with carriages, for the Oscar Frederiksborg fortifications. The company has also secured an order for twenty-three rapid-firing guns of their own construction, this order being the outcome of exhaustive trials by the Swedish artillery of guns from the Société Nordenfeldt, Paris; Bofors, Gullspong, Sweden; Stockholm-Vopenfabrik, and Finspong. They have also orders for about 1,000 cast-iron projectiles.

UNITED STATES.—A test of the new Krag-Jorgenson rifle was made very lately at Willets Point, under the direction of Captain W. M. Black, Corps of

Engineers. In order to ascertain the penetrative ability of the bullets, pine boards were fastened together until a thickness of 50 inches was obtained. Two of the shots fired at this target, at short range, went entirely through it, and none of them penetrated less than 3 feet. Into oak planks the penetration was 32 inches, and iron plates two-thirds of an inch were also pierced. A bullet fired at thin iron plates an inch apart passed through one plate after another until it melted.

FOREIGN PERIODICALS.

NAVAL.

AUSTRIA-HUNGARY.—*Mittheilungen aus dem Gebiete des Seewesens.*—No. 4. Pola and Vienna: April, 1895.—"The New Coast-Defence Armoured Ships for the Imperial Navy, 'Monarch,' 'Wien,' and 'Buda-Pest.'" "Remarks on the present forms of Bows and Sterns of Modern Racing Yachts." "The Sinking of the 'Elbe.'" "Foreign Navies in 1894." "On the Efficacy of Bilge-Keels." "The French Battle-ships 'Magenta' and 'Hoche.'" "The Reconstruction of the Italian Battle-ship "Dandolo.'" "The Russian Armoured Cruiser 'Rurik'" (with plans). "The United States Double-Turreted Monitor 'Monterey.'" "On the Necessity of Substituting for Wood on Board Ships some Non-Inflammable Material." "Book Notices," etc.

DENMARK.—*Tidskrift for Söväesen.*—Copenhagen: No. 1, 1895. "On the Use of Sails in Steam Vessels." "Electric Search-lights and their Use for Naval Purposes."

FRANCE.—*Revue Maritime et Coloniale.*—Paris: February, 1895.—"The English Torpedo Gun-boats of the First Class." "Report on the Measures to be taken for Detecting the Adulteration of Olive Oil." "Study on the Present Mountings of Heavy Guns." "Graphic Method for Determining Rapidly the Variations of the Compass." "Geometry of Diagrams" (*continued*). "Naval Chronicle: England, Holland, Austria, Italy." "Naval Tactics: the Battle off the Yalu." "Torpedo-boats." "The Sea Fisheries."

Le Yacht.—Paris: 2nd January, 1895.—"On Corsair-Cruisers" (E. Weyl). "The new Champion Defender of the American Cup." "Electricity: Telegraphic Communication Without Intermediary Conductors." "The new Twin-screw Trans-Atlantic Liner 'Saint Louis.'" "Naval Technical Association: Discussion on Papers by MM. Normand and Daymard." "Yachting News." "The New Works at the Port of Havre" (with plan). "Naval Chronicle, Home and Foreign." 9th March.—"The Question of Battle-ships" (E. Weyl). "Yachting News: Cannes Regatta." "The Bulb-keel for Yachts." "The Italian Ram-Torpedo-Cruiser 'Umbria'" (with two plates). "The Professional and Technical Instruction for the Sea Fisheries." Naval Chronicle, Home and Foreign." 16th March.—"The English Naval Estimates" (E. Weyl). "Yachting News: the Regattas in the Mediterranean." "The French Naval Budget." "Naval Chronicle, Home and Foreign." 23rd March.—"The Navy and the Chamber of Deputies" (E. Weyl). "Yachting News." "Naval Technical Association: Discussion on Hulls and Machinery, Formulæ relating to the Work of Resistance." "The New Spanish Armoured Cruiser 'Emperor Charles V.'" "Trials of the 'Friant.'" "Naval Chronicle, Home and Foreign." 30th March.—"The English Navy in the House of Commons" (E. Weyl). "Yachting News." "Remarks on the Italian Navy" (Jack la Bolina). "The New Steam Life-boat 'City of Glasgow.'" "The New Russian Imperial Yacht 'Standard.'" "Naval Chronicle, Home and Foreign."

Le Moniteur de la Flotte. Paris: 2nd March, 1895.—"Naval Affairs in Germany" (Marc Landry). "Colonial Notes." "The War between China and Japan." "Official Announcements." "Naval Chronicle, Home and Foreign." 9th March.—"The Navy at Kiel" (Marc Landry). "The Navy in Parliament." "The Iceland Fisheries." "Madagascar." "Official Announcements." "Naval Chronicle, Home and Foreign." 16th March.—"English and French Battleships" (Marc Landry). "The Navy in Parliament." "The Naval Budget." "The English Naval Estimates." "Madagascar." "Colonial Notes." "Official Announcements." "Naval Chronicle, Home and Foreign." 23rd March.—"The Discussion on the Budget" (Marc Landry). "The Sea Fisheries." "The Destruction of the Chinese Navy." "Colonial Notes." "Official Announcements." "Naval Chronicle, Home and Foreign." 30th March.—"The Regulation Lights Carried by Vessels" (Marc Landry). "The Sea Fisheries." "The Command of the Navy at Majunga." "Foreign Yachts." "Madagascar." "The Extra Parliamentary Commission on the Navy." "The War between China and Japan." "Official Announcements." "Naval Chronicle, Home and Foreign."

La Marine de France. Paris: 10th March, 1895.—"The Defence of the Coasts and the Navy." "Doctors in the Colonial and Naval Services" *(concluded)*. "Yachting and the Fisheries." "An International Tonnage System." "Lights carried by Ships *à propos* of the 'Elbe' Catastrophe." "The Geographical and Colonial Movement." "Naval Chronicle: Home, England, Germany, Holland, Italy." "Book Notices." 25th March.—"Custozza and Sadowa" (Rear-Admiral Réveillère). "The Minister of National Defence." "The Discussion on the Naval Budget." "Yachting." "An International Tonnage System and the Yacht Club of France." "The Geographical and Colonial Movement." "Naval Chronicle: Home, England, Spain, Russia, and United States." "The Question of Bi-metallism and the Chamber of Commerce of Marseilles."

GERMANY.—*Marine Rundschau.* Berlin: April, 1895.—Continuation of Translation of Captain Mahan's "Influence of Sea Power on History." "War-Indemnity and Formosa" (with sketch). "Inferences from the Chino-Japanese Naval Batties with regard to the Construction and Armament of Ships." "The Losoten-Islands Fisheries." "Chronometers and the Value of Temperature Corrections." "Experiments with Propellers made out of cast-steel and nickel-steel respectively." "Foreign Naval Notes: England, France, Sweden, Turkey, and United States." "Book Notices." "Official Announcements," etc.

ITALY.—*Rivista Marittima.* Rome: March, 1895.—"Naval Strategy" (D. Bonamico). "Some Considerations on Maritime Meteorology" (with explanatory diagrams). "Oscillating Experiments carried out with Models of Ships" (with diagrams). "Modern Marine Engines." "The War-navy of Cosimo I., Duke of Tuscany, and his immediate successors" *(continued)*. Letters to the Editor: "Some Questions connected with Naval Organisation" (with table of armaments). "Foreign Naval Notes: France, the 'Friant,' 'Chasseloup-Laubat,' and Latouche-Tréville,' the alterations in the 'Hoche,' the new coast-defence ship 'Bouvines' (with photograph of ship); England, Notes on the cruisers in course of construction, etc.; Italy, Notes on new constructions (with plates); Holland, the new cruisers." "Notes on Mercantile Marine." "Notices of Books."

RUSSIA.—*Morskoi Sbornik.* St. Petersburg: November, 1894.—"The Combined Operations of Army and Fleet." "The Influence of the Depth of Water on the Speed of Ships." "The Use of Coal on War-ships." "Competitive Armour-plate Trials at Ochta, in June, 1894." "The Storms of the Caspian Sea." "The Removal of the Difficulties connected with Deviation in Modern Ships."

December, 1894.—"On the Question of Cruiser-war." "On Ice-breakers." "Some Questions connected with the Barometer." "The Storms of the Caspian Sea" (*concluded*). January, 1895.—"Regulations for the Entry of Boys into the Lower Class of the Naval-Cadet Corps, and Programme for the Entrance Examinations in 1895." "A Glance at the Naval Operations in the Chino-Japanese War" (*continued*). "The Engines and Boilers of the Armoured-cruiser 'Rurik.'"

SWEDEN.—*Tidskrift i Sjöväsendet.* Carlscrona: No. 1, 1895.—"The Year's Report on the Working of the Royal Veteran's Association." "How can Fire be best directed from a Sea Fort upon a Ship; and can any Systematic Training for this Object be carried out?" "The Fleet during the past year." "The Chino-Japanese War." "Extract from the Instructions for the Training of the General Staff." "A Question of Names." "Proposal for the Formation of an Inspection Association for the Swedish Merchant Navy." "Another word about Signals."

SPAIN.—*Revista General de Marina.* Madrid: March, 1895.—"Asia: A Discussion on Naval and Military Aspects." "Some Lessons from the Naval Battle off the Yalu." "A Treatise on the Chino-Japanese War." "Aid to the Wounded and Shipwrecked in Naval War." "Collision Mats" (with plates). "Launch of the Armoured-cruiser 'Charles V.'" "Loss of the 'Reina Regente.'" "Vocabulary of Powders and Modern Explosives." "Notices of Books."

MILITARY.

AUSTRIA-HUNGARY.—*Mittheilungen über Gegenstände des Artillerie und Geniewesens.* Vienna: March, 1895.—"On the best Method of Measuring Distances in War." "How the Technical Troops were employed in the Great Manœuvres of 1894" (with maps and tables). "Remarks on the Indirect Pointing-method of the Italian Field Artillery" (with plates). "An Automatic Apparatus for Blowing-up an Enemy's Railway-trains when Moving." "New form of Transport-wagons for Narrow-gauge Railways" (with plates). "Technical Notes." "Book Notices."

Organ der Militär-wissenschaftlichen Vereine. Vienna: March, 1895.—"Small-bore Rifles and the Question of Wounds therefrom" (Dr. I. Habart Imp, Austrian Army). "The Caucasian Cossack-Brigade in the Balkan Campaign of 1877-78." "Book Notices." April, 1895—"On the Theoretical Higher Education of Officers and Cadets." "Notes on the latest advances in Photography and the best Method of Reproduction" (with plate). "Book Notices."

FRANCE.—*Revue de Cavalerie.* Paris: February, 1895.—"The Cavalry at the Manœuvres." "The Division of the Cavalry of the Guard in the Italian Campaign of 1859" (with list of Itineraries). "Some Studies as to the best method of fighting for Cavalry when dismounted" (with plate). "The Calling-out of two Reserve Cavalry Regiments" (*conclusion*). "General Jeantet." "Military Notes, Foreign." "Official Announcements."

Revue d'Artillerie. Paris: March, 1895.—"The Corps of Artillery of France: an Historical Study." "The Mortar in the Russian Campaign, 1877-78." "The Simplon Tunnel" (with plan). "Distribution of Flaws in Metals when Subjected to Strains" (with plates) (*continued*). "On the Law of the Resistance of Air" (*concluded*). "Foreign Military Notes." "Book Notices." "Official Announcements."

Revue Militaire de l'Étranger. Paris: March, 1895.—"The Independent Congo State and its Military Forces." "The Chino-Japanese War (with maps)

(*continued*). "The Winter Manœuvres in Germany." "The Italian General Staff." "Foreign Military Notes."

Revue du Service de l'Intendance Militaire. Paris: January and February, 1895.—Has not yet been received.

Journal des Sciences Militaires. Paris: March, 1895.—"Strategy of Battle" (General Lewal) (*continued*). "The late Marshal Canrobert." "General Principles of Plan of Campaigns" (*continued*). "Reconnoitring Service in Mountains" (with plan). "The Campaign of 1814: the Cavalry of the Allied Armies during the Campaign of 1814" (*continued*). "The Tarentaise." "The French Army in 1690" (*continued*). "New Military Works."

Le Spectateur Militaire. Paris: 1st March, 1895.—"The Defensive Arms of Infantry." "A Retrograde Step in the Matter of Advancement." "The Old Army: its Basis of Organisation (*to be continued*). "The Ideas of General Trochu" "Military Chronicle of the Week." "Review of the Foreign Military Press." "Notices of Books." 15th March.—"The War Budget for 1895: General Discussion" (*to be continued*). "Duelling in the Army and in Civil Life." "The Old Army" (*continued*). "Military Chronicle of the Week." Review of the Foreign Military Press." "Notices of Books."

Revue du Cercle Militaire. Paris: 9th March, 1895.—"The Military Week." "Madagascar." "The Lefebvre Transport-wagons and the Expeditionary Force to Madagascar" (*concluded*). "The 13th Corps d'Armée during the War of 1870" (*continued*). "Military Notes, Home and Foreign. "Official Announcements." 16th March.—"The Military Week." "Medical Statistics for the French Army During 1892." "Madagascar" (*continued*). "Military Notes, Home and Foreign." "Official Announcements." 23rd March.—"The Military Week." "Madagascar." "The 13th Corps d'Armée during the War of 1870" (*continued*). "Military Notes, Home and Foreign. "Official Announcements." 30th March.—"The Military Week." "The Sacred City of Moukden" "The 13th Corps d'Armée during the War of 1870" (with plans) (*continued*). "Military Notes, Home and Foreign." "Official Announcements."

GERMANY.—*Militär Wochenblatt.* Berlin: 2nd March, 1895.—"The Archduke Albrecht of Austria, In Memoriam." "How Does the Soldier keep his Feet Warm in Winter?" "Extracts from the Annual Report of the Secretaries for the Navy and for War in the United States." "Military Notes, Home and Foreign." 6th March.—"The Advance and Deploying of Field Artillery in Action." "The French War Budget." "New Regulations for the Russian Army Transport in War." "Military Notes, Home and Foreign." 9th March.—"Advance and Deploying of Field Artillery in Action" (*concluded*). "Remarks on the Riding School." "Madagascar." "Military Notes, Home and Foreign." 13th March.—"The Military Association of Berlin: its Proceedings." "Freedom of Formation, or a Practically Arranged Attack?" "Madagascar" (*concluded*). "French Manœuvres for 1895." "Military Notes, Home and Foreign." 16th March.—"Some Treatises on the Principles of Training and the Art of Riding." "The Fighting Equipment of the Cossacks." "The Peace Strength of French Batteries." "Military Notes, Home and Foreign." 20th March.—"The Jubilee Year of the Uhlans" (*continued*). "The Carrying-out of the Italian Army Re-organisation." "Military Notes, Home and Foreign." 23rd March.—"The 22nd March." "The Jubilee Year of the Uhlans" (*concluded*). "The French Horses for Mobilisation." "Military Notes, Home and Foreign." 27th March.—"The Dutch Operations Against Lombok in 1894." "Cavalry Divisions in Peace Time." "Military Notes, Home and Foreign." 30th March.—"The 1st April." "Cavalry Divisions in Peace Time," (*concluded*). "The Free Corps of the Allies in 1813." "Infantry Horses in France." "Military Notes, Home and Foreign."

Jahrbücher für die deutsche Armee und Marine. Berlin : April, 1895.—Has not been received up to time of going to press.

Neue Militärische Blätter. Berlin : February, 1895.—"The Importance of Numbers in Armies." "The Defence of the Shipka Pass" (*continued*). "The Recruiting Results in France." "The Franco-Italian Alpine Frontier and its Defence" (*continued*). "The War in East Asia" (*continued*). "Experiments with the Italian 6·5-millimetre Rifle against Horses." "Strategic Tactical Problems." "Military Notes, Foreign." "Book Notices."

NOTE.—Owing to some irregularity in transmission the February number of this Journal was not received until after the March. The April number had not been received up to time of going to press.

ITALY.—*Rivista di Artiglieria e Genio.* Rome : March, 1895.—"Logarithmic Tables for Calculating Initial Velocity." "Some Views on the Manual of Field Fortification" (with five plates). "The Present State of the Question of Field Guns." "The Characteristics of Firing from Coast Batteries." "Miscellaneous Notes : On the Manœuvring of German Field Artillery ; The New Firing Instructions for the Russian Field Artillery ; The Fortifications of the Bosphorus and Dardanelles" (with map). "Foreign Military Notes." "Book Notices."

SPAIN.—*Revista Técnica de Infantería y Caballería.* Madrid : April, 1895.—"General Esponda." "The Pocket Phono-Telémetre." "On Military Promotions." "Cavalry on the Field of Battle." "The War in Cuba."

SWITZERLAND.—*Revue Militaire Suisse.* Lausanne : 1st March, 1895.—"The Corps d'Armée according to the Decree of 28th September, 1894." "Musketry Courses in the Infantry" (*concluded*). "Trials of Penetration of Snow by Projectiles." "Hygiene and the Nourishment of the Horse in the Field" (*conclusion*). "Belgium and Switzerland." "Officers' Society.—General Assembly." Vaud Section : "Assembly of Delegates." "Military Notes, Foreign." "Notices of Books."

UNITED STATES.—*The United Service.* Philadelphia : April, 1895.—"The Supply of the Armies of Frederick the Great and Napoleon." "Yesterday in Annapolis." "Arab Men and Arab Horses." "Origin and Developments of Steam Navigation" (the late Rear-Admiral Preeble, U.S.N.) (*continued*). "Among Our Contemporaries." "Naval and Military Notes." "Service Salad." "Military Order of the Loyal Legion of the United States."

Journal of the Military Service Institution. New York : April, 1895.—Has not been received up to time of going to press.

NOTICES OF BOOKS.

Notes on the Year's Naval Progress. No. XIII. Navy Department : Office of Naval Intelligence, Washington, 1894.

The new issue of this invaluable work, which the United States Naval Intelligence Department has now for some time past annually published, is this year larger and more replete with information on all naval subjects of interest than even its predecessors have been. Chapter I. contains some short details of the Naval Administration of Austria, England, France, Germany, Italy, and

Russia, accompanied by tables, showing how officers in each country are apportioned to the different departments. Chapter II., as usual, is devoted to the new ships and torpedo-boats either laid down, launched, or on trial during the year; and there are the excellent plans of ships, which readers of the work are accustomed to look for, together with good instantaneous photographs of three of the latest French torpilleurs-de-haute mer, when running at high speed. Chapter III., on ordnance and torpedoes and armour-plate trials, is also profusely illustrated with plates of the latest Elswick, French, and Krupp guns and mountings, etc., and will well repay the reader by the amount of information which it contains in a comparatively small compass, and there are also some excellent reproductions from photographs of armour plates, submitted by the different leading European firms for trial in Holland and France, showing their appearance at the conclusion of the ordeal to which they were subjected, while the results are very clearly and concisely described. Chapter IV. is devoted to the various small-arms now in use, with plates and comparative tables of the latest pattern small calibre rifles. Chapter V. contains interesting notes on Naval Dynamo Machinery, while in VI. and VII. we have descriptions of different types of water-tube boilers, illustrated with plates, and concluding with the recommendation of the Committee appointed by the Admiralty in 1892 to consider the existing types of engines and boilers in H.M. ships. The volume concludes with a *résumé* of the Naval Manœuvres carried out in 1893 by the English, French, and Italian Fleets, with explanatory charts, and a brief but interesting description of the naval operations in Brazil during the late Civil War, with maps, and an excellent photograph showing the damage done to the bow of the "Aquidaban" by the torpedo which sunk her. It will be difficult to find a volume more full of interest to anyone wishing to keep up-to-date in naval matters than this latest issue of the "Year's Naval Progress."—H.G.

Aide-Mémoire de l'Officier de Marine.—By E. DURRASSIER, Chef de Bureau au Ministère de la Marine, and C. Valentino. Paris: Baudoin, 1895. 3f. 50c.

The eighth issue of this useful work of reference opens, as it did last year, with comparative tables of the battle-ships, armoured cruisers, cruisers, and other vessels of the different powers. The authors exclude all ships built over twenty years, and also all vessels building and not yet ready for their trials, and they credit England this year with forty-one armoured ships, as against thirty-nine for France, sixteen for Russia, twenty for Germany, and ten for Italy; in the matter of unarmoured vessels, they admit an undoubted superiority lies with this country, which is credited with 138 cruisers, torpedo-gunboats, and torpedo-destroyers, etc., as against forty-three French, thirty-two Russian, forty German, and forty-three Italian. Passing to the contents, we find that they are practically the same as in the two last editions, beginning with a valuable *résumé* on international maritime law, which includes chapters on territorial waters, the definition of the terms "ship of war" with its rights, immunities, etc., on merchant ships, reprisals, state of war, neutrality, blockade, contraband of war, right of search, and other kindred subjects; then come tables of rates of pay of naval officers in the different services, followed by a chapter descriptive of the various types of ship in the German, English, Austrian, Italian, Russian, and United States Navies, showing their method of construction, machinery, armament, and defensive powers; after which are the usual tables of the war-ships of all countries with the names, dimensions, armament, etc., of each ship. A chapter on guns, accompanied by minute and exhaustive comparative tables, comes next; and an interesting chapter on torpedoes, submarine mines, torpedo-boats, catchers, and torpedo warfare generally, practically concludes the book. Those having friends in the French Navy will find the Rank List of the officers at the end of the book of interest, and there is further a useful list of the ships in commission, with their different stations and the rank of the officers in command.—H.G.

La Défense des Côtes d'Europe: Étude descriptive au double point de vue Militaire et Maritime (with atlas containing 204 plans). By CARL DIDÉLOT, Lieutenant de vaisseau. Paris: Berger-Levrault et Cie., 1894.

A remarkable work in its way, which must have cost its author an immense amount of time and trouble, as he gives a description of all the European and Mediterranean sea-fortresses with maps, showing—marked in red—the position of the different forts and defensive works protecting each place, as well as details with regard to their armament, etc.

The fortresses in Germany, for instance, appear as:—Wilhelmshaven, Jahde-Weser, the Mouth of the Elbe, the North-Sea Canal, Heligoland, Kiel, Lubeck, Wismar, Rostock, Rügen, Stralsund, Usedom and Wollin, Swinemünde, Kolberg, Rügenwalde, Stolpenmünde, Danzig, Pillau, and Memel.

In France:—Dunkirk, Calais, Havre, the Mouth of the Seine, La Hougue, Saint-Malo, Saint-Servan, Cherbourg, Brest, Lorient, the Mouth of the Loire, Saint-Nazaire, La Rochelle, Rochefort, Les Pertuis, La Gironde, Port Vendre, Marseille, Nice, Villefranche, Toulon, Bastia, Ajaccio, Porto-Vecchio, and Bonifacio.

The list of fortresses of the two countries given above are sufficient to show how useful the book and plans are. In spite of the many inaccuracies which must, almost of necesssity, find their way into a work of this kind, it will be found extremely interesting and useful, and the author may fairly claim to have accomplished a task which is unique in the Naval and Military literature of the day, and he is to be heartily congratulated on the excellent way in which he has carried though the task he set himself.—H.G.

Lucknow and Oude in the Mutiny. By Lieut-General MCLEOD INNES, V.C. London: A. D. Innes and Co. Price, 12s.

This is the most valuable contribution to the history of the Indian Mutiny which has appeared for many years; and none even of those who are conversant with the works of Kaye and Malleson, Holmes, and other authentic historians of the greatest and most momentous mutiny of modern times, can peruse this carefully written and authentic narrative without deriving much valuable information from it. Perhaps the most marked characteristics of the work are the methodical arrangement of its several parts, and the clear and full headings of the chapters. The author prefaces his actual narrative with a retrospective view of the causes and origin of the outbreak. Among the former he includes the autocratic rule of Lord Dalhousie, and, later, the premature introduction of the "general service" system of recruiting by Lord Canning.

General Innes does ample justice to the marvellous prescience, the patient fortitude, and the skilful daring of Sir Henry Lawrence; and he is generous, but not lavish, in his laudation of Neill, Havelock, Outram, and other commanders, and of many men and corps that showed remarkable gallantry and endurance. Yet there is one omission that should not pass unnoticed. In describing the successful action fought under Franks on the 23rd of February, 1858, he says:—"The Sultanpore action was well managed"; but of his own act of "splendid daring," so vividly described by Malleson, and for which the Victoria Cross was deservedly awarded, there is not a word. The author deals gently, yet plainly, with those who failed to take advantage of their opportunities for glorious or decisive action; and in one case, where the inactivity of a commander was followed by serious consequences, the name of the delinquent is not given.

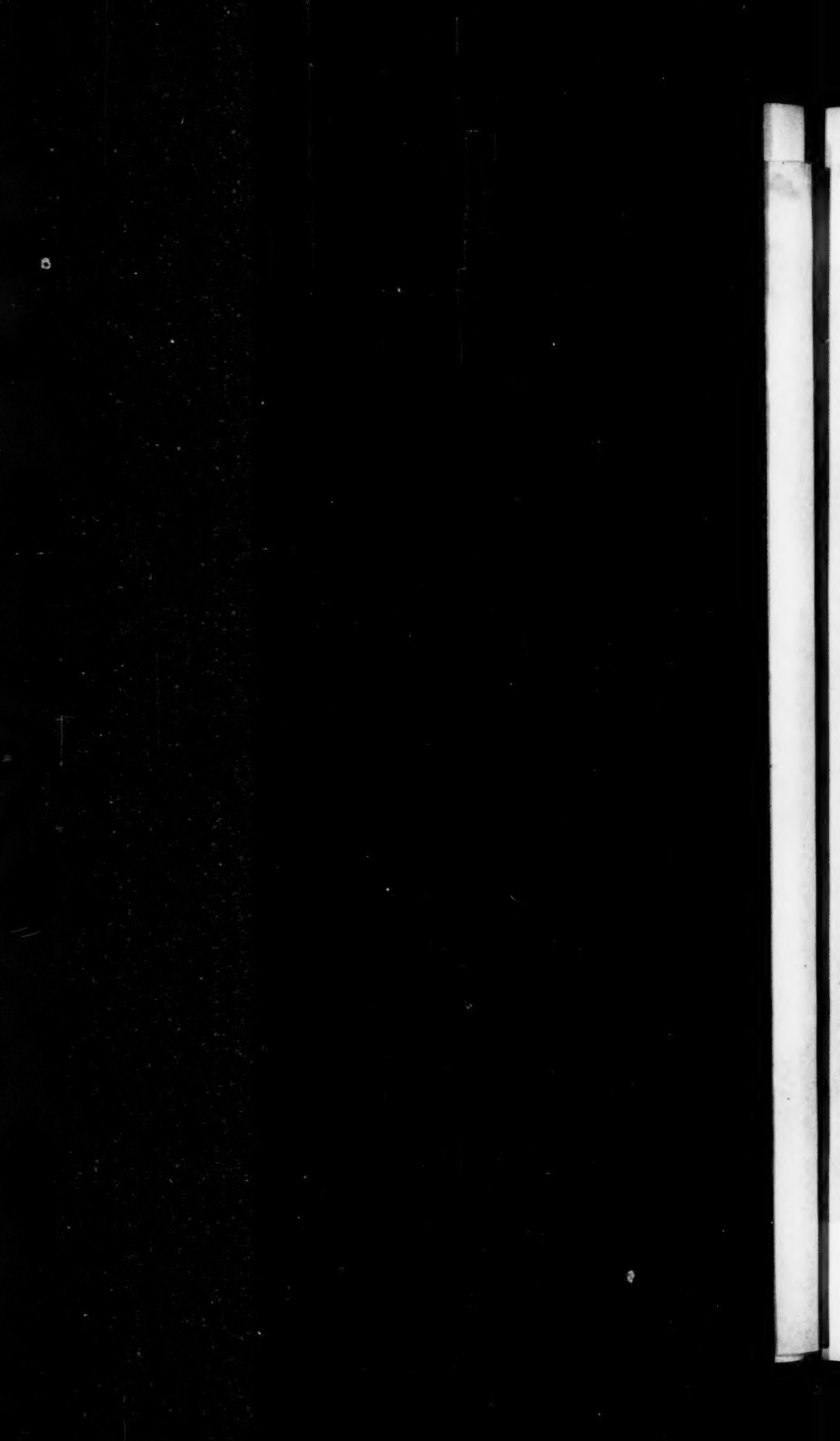
The story of the disastrous action of Chinhut on the 30th of June, and of the "First Defence" of the Presidency till the relief by Havelock on the 25th of September, is told vividly and clearly; and the mining operations, in which the author, as an officer of Engineers, was constantly engaged, are described with

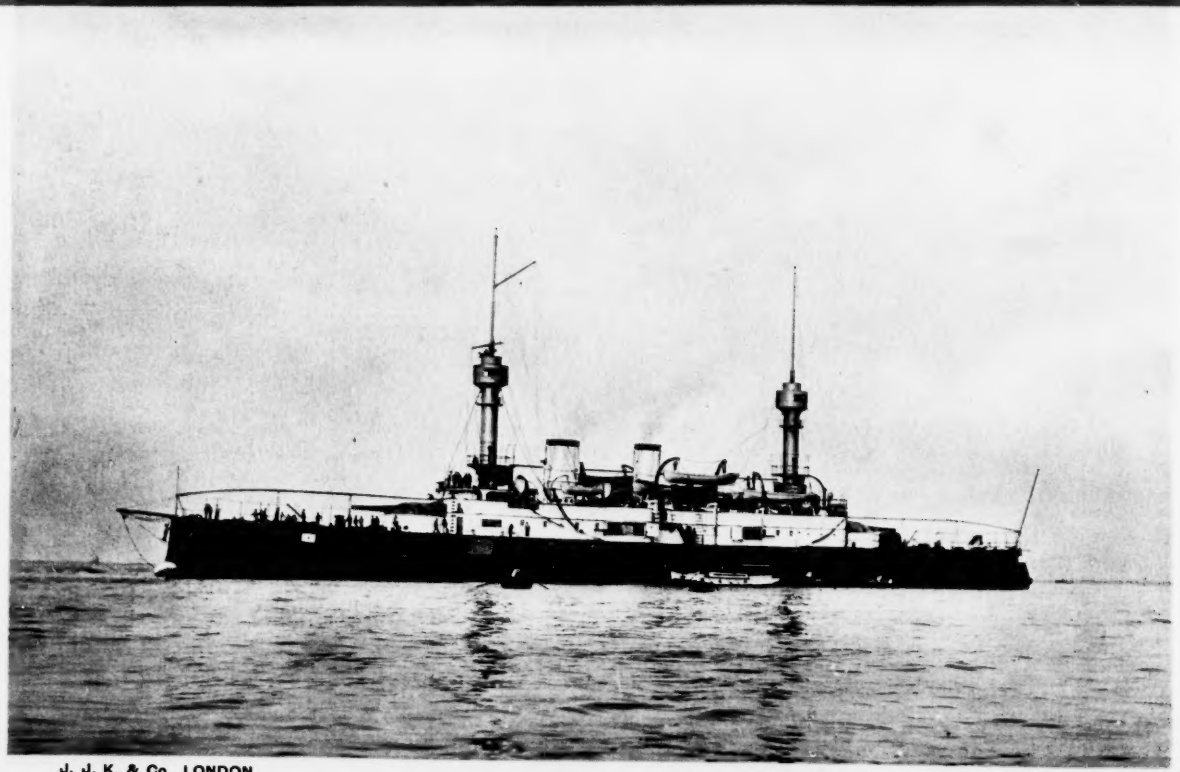
much minuteness of detail. Havelock's campaign, from his leaving Cawnpore till his relief of Lucknow; the "Second Defence" under Outram; the final capture by Sir Colin Campbell; and the eventual suppression of the revolt, are carefully and temperately dealt with. The author estimates more highly than do most writers of the present day, the military value of the "old Hindustani Sepoy" in comparison with the more warlike races of northern India who have deservedly risen in favour since the events recorded in his work.

The author retains throughout his work the familiar form of spelling Indian names of places, instead of adopting the new or "transliteral" mode, which has attractions for some Oriental scholars, but is only a source of bewilderment to ordinary English readers. The book is well and carefully printed, and is attractive in appearance. There are some few typographical errors, chiefly in proper names, but these are evident to readers who are familiar with the story of the mutiny, and are, therefore, unlikely to lead to any misconception. The work is amply illustrated with plans and "panoramic" views of Lucknow in its many aspects, and clear explanatory notes are appended to each plate. The utility of the volume and the convenience of its readers would be enhanced by the addition of a copious index which may be hoped for in a future edition.—E. O'C.

The 43rd and 52nd Light Infantry Chronicle, 1894. (London: Eyre and Spottiswoode.)

What was said last year in regard to the *Chronicle* for 1893 applies with equal force to the present issue. The book, which was originated with the best intentions, records the doings of two of the most distinguished regiments in the British Army—regiments which, before their linking together in 1881 as the Oxfordshire Light Infantry, were companions-in-arms in some of the greatest victories of the Peninsula. In addition to the actual record for the year, there is a variety of miscellaneous literature bearing on the histories of both regiments; some of it of antiquarian interest, but all of it sound and wholesome reading. Not the least valuable portion of the *Chronicle* are the illustrations, which are unusually excellent and well executed, the frontispiece of Lieut-Colonel Henry Booth, K.H., being a work of art. Both the 43rd and 52nd are noted for their *esprit de corps* and high tone, and it is in the historical portion of such books as the one under review that young officers, and even the elders, learn the spirit and high principles of their predecessors; while in the record of yearly events, their comradeship and regimental feeling is cemented. The *Chronicle* is compiled and edited by Captain A. F. Mockler-Ferryman, a 43rd man, now Instructor at Sandhurst, and the successful result of his painstaking efforts is apparent in one of the best regimental periodicals published.—R.H.





J. J. K. & Co., LONDON.

For Particulars, see Naval Notes, page 517.

The New Austrian Armoured Ram-Cruiser

"KAISERIN UND KÖNIGIN MARIA THERESIA."